

Syntactic Priming of Ditransitive and Dative Constructions within and across
Languages in High School English Learners

By

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Abstract

Syntactic priming refers to the phenomenon in which people tend to produce a sentence structure that they have previously encountered. Syntactic priming research, taken as a useful tool for probing into bilingual syntactic representations and processes, has become a focus of psycholinguistics since the 21st century. However, there is insufficient research on second language learners who speak distant languages and there are no peer-reviewed studies comparing English-English syntactic priming with Chinese-English priming. Also, only a few syntactic priming studies target the high-school population. To address these gaps, this study investigated within-language (English-English) and between-languages (Chinese-English) syntactic priming on high school students. The primary aims are to understand Chinese high school English learners' bilingual representation, and shed light on syntactic priming research in terms of how different factors influence the occurrence of priming effects. Additionally, this study provides implications for second language acquisition from the perspective of psycholinguistics. Specifically, this study examines whether priming occurs on the high-school population and how it is affected by priming languages and language proficiency. The research design adopted a typical paradigm for syntactic priming research — the Sentence Completion Task (Pickering & Branigan, 1998). Sixty high school students participated in the experiment. Half of the students were considered low English proficient and half were considered high. Participants were asked to complete a sentence completion task and a questionnaire

about their background information. The data analysis involved mixed ANOVA and t-tests.

The results indicated that the types of priming structures, L2 proficiency, and priming languages interactively influenced the magnitude of syntactic priming effects. Both double objects and prepositional objects showed priming effects. Overall, the effects in the high proficiency group were larger than those in the low proficiency group; the within-language effects were also larger than the between-languages ones. The results indicated that the low proficiency participants remained at the stage of item-specific representation in L2; L2 representation of the high proficiency participants has become abstract but still separate from L1. The findings provide some evidence in support of the developmental view of the syntactic representation. Findings also have implications for theory and practice.

KEY WORDS: syntactic priming; high school English learners; bilingual syntactic representation

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List of Abbreviations

DO	Double objects
PO	Prepositional object
NP	Noun phrase
L1	The first language
L2	The second language
EFL	English as Foreign Language
ESL	English as a second language
Sth	Something
Sb	Somebody

Chapter 1 Introduction

Research Background

It has become universal today for people to be able to speak several languages and it is ubiquitous for students to learn foreign languages in modern society. Under such a background, issues about second language learning, bilingualism, and multilingualism have become topics of interest in the domain of psycholinguistics. Compared to monolinguals, it is believed that the way second language learners represent and process syntactic information of languages is different. This is in part because learning a new language changes the manner a person stores or processes languages in their mind. Also, how similar or how distant the second language is from the mother tongue may bring about different degrees of influence. As Gunnar, Kalliopi, Neiloufar and Allen (2017) pointed out, “a key question in psycholinguistic research on multilingualism is the extent to which the two languages of a bilingual individual interact with each other during the processing and production of sentences” (p. 269).

Mental representation is an abstract concept as it is unobservable. As such, linguists have used assumptions as a basis for their investigations (Branigan & Pickering, 2017). Two assumptions about second language learners’ syntactic representation are the separate representation and the shared representation.

Although mental representation is abstract and unobservable, the syntactic priming effect provides an implicit method to probe into the representation of syntactic information and can test the assumptions as well. Syntactic priming is

known as an influential tool to probe into the nature of syntactic representation of both native and second language learners (Pickering & Ferreira, 2008). Gunnar et al. (2017) argued that research on within-language syntactic priming and cross-linguistic syntactic priming could provide considerable insights into whether L1 interacts with L2 in bilinguals' mind.

Syntactic priming is also known as structural priming and syntactic persistence. The syntactic priming effect refers to the phenomenon that “speakers are more likely to choose a particular syntactic structure after having processed a sentence with the same structure recently, as opposed to an alternative structure” (Hartsuiker & Bernolet, 2017, p. 219). Alternative structures are the kind of structures which have different forms but have the same meanings and thus can be alternatively used, such as double objects and prepositional objects. More details about syntactic priming effects will be provided in the literature review.

Increasingly, experimental studies of syntactic priming have shown mixed results as the syntactic priming research spreads to different languages and different populations, and uses different paradigms. Mixed results suggest that the nature of second language learners' syntactic representation cannot be simply explained by either the separated or the integrated representation theory alone. As such, a developmental viewpoint has surfaced which proposes that syntactic representation is always in the process of development just as language acquisition develops. However, the latest developmental viewpoint is based on limited research findings. Therefore, its acceptability and generalizability require further research and verification.

The syntactic priming phenomenon is simple, but its occurrence is complicated and affected by many factors. Therefore, syntactic priming effects have attracted attention from researchers, especially those interested in second language learning. The current study will target second language learners at the high school level. Specifically, this study aims to investigate the syntactic priming phenomena of Chinese-English bilinguals at the high school level and focuses on the issue of whether they will show syntactic priming effects and how the magnitude of effects is influenced by various factors.

Research Significance

This research is important because English education plays a central role in Chinese high school students' English language development. Also, this study is unique in that it focuses on syntactic priming in language production rather than in comprehension. Among the four literacy skills in English (listening, speaking, reading, and writing), it is common that writing and speaking are Chinese students' weaknesses. According to the most recent International English Language Testing System (IELTS) yearly test statistics in 2016 (<https://www.ielts.org/teaching-and-research/test-taker-performance>), Chinese test takers had the lowest scores in production (writing and speaking). Specifically, the mean individual band scores of Academic test takers originally from China are (writing) 5.34 and (speaking) 5.39, (listening) 5.84, (reading) 6.08. Given Chinese English learners' and speakers' production capacities were inferior to their comprehension, this study investigated Chinese students' production rather than comprehension, with an attempt to shed light

on how to improve students' language production. The current study's significance is threefold: 1. it investigates second language learners' syntactic representation, 2. it provides implications for second language acquisition and teaching, and 3. it sheds light on the phenomenon of syntactic priming and helps us have a greater understanding of how it is affected by various factors.

The mental representation of syntactic information. Findings from studies that have examined the mental representations of syntactic information are inconsistent (Miao, 2015). This suggests that further research related to syntactic representation is needed.

The results of this study will contribute to understanding the state of Chinese high school English learners' syntactic representation in their first and second language and whether the high school students in this study use the separate representation or the shared representation. Although mental representation is abstract and unobservable, syntactic priming is a powerful measure of the shared representation (Dell & Ferreira, 2016). Researchers argue that the occurrence of syntactic priming across languages, namely that processing the syntactic structure of one language can influence the subsequent production of another language, can indicate a shared-syntax representation between two languages (Hartsuiker & Bernolet, 2017). Hartsuiker and Pickering (2008) argued that if within-language priming effect is as strong as between-languages priming effect, this could be compelling evidence for the fully integrated representation of the two languages.

The findings of this study will also demonstrate whether second language

learner's bilingual syntactic representation is developmental. Additionally, this study will show how syntactic representation develops by providing evidence from a population that has been tested less frequently, namely high school students.

According to existing research, the magnitude of syntactic priming effects is closely associated with the proficiency of the second language. A stronger syntactic priming effect suggests a higher degree of sharing and might depend on a higher proficiency in the second language. As Hartsuiker and Pickering (2008) said, "it is, of course, possible that the degree of sharing might be greater for proficient bilinguals, for bilinguals who learned their L2 early (or learned both languages at once), or for bilinguals who speak typologically more closely related languages" (p. 451).

Moreover, the developmental model proposed by Hartsuiker and Bernolet (2017) suggests that second language learners' representations of their first and second language go through several stages, from being completely separated to gradually merging as their second language develops.

To verify the arguments above, there should be evidence from research on a wide range of second language learners at different stages and across different languages.

Despite a large amount of evidence for shared representations from proficient bilinguals whose two languages are closely related (e.g., Dutch and English; both are Indo-European languages), there is lack of evidence from less- or non-proficient second language learners whose two languages are distant (e.g., English and Chinese, Chinese being Sino-Tibetan language and English being Indo-European language). As such, this study will investigate both within-English and Chinese to English syntactic

priming effect on Chinese senior high school students. This study will include both low and high proficiency groups to determine whether the representation of syntactic information develops with the improvement of L2 proficiency. The research results may provide evidence for the generalizability of the developmental model by Pickering and Branigan (2017).

Second language acquisition. The occurrence of syntactic priming can provide evidence that syntax is learned and adapts during language exposure; it can reveal the stage of syntactic representation of second language learners (Dell & Ferreira, 2016). As described earlier, Chinese students' English production ability is relatively weak. The findings from the current study may have implications in terms of how to facilitate students' production ability. From the perspective of second language acquisition, syntactic priming research has the following significance.

Theoretically, the occurrence of syntactic priming implies that greater exposure to one type of sentence structure can help reduce second language learners' cognitive load when they reuse or reproduce that sentence structure. The occurrence of syntactic priming can suggest the abstract representation within languages and the shared representation between languages. The abstract and shared presentation means less storage space and also a lower cognitive load during the process of L2 syntactic production (Dell & Ferreira, 2016). Thus, if the within-language or between-language syntactic priming effects occur with Chinese senior high school students, it is possible that Chinese teachers can consolidate students' mastery of certain structures implicitly by providing greater exposure to those structures. For example, teachers could expose

Chinese students to more Chinese or English PO than DO for the sake of English native speakers' slight preference for PO structures to DO structures (Flett, Branigan, & Pickering, 2013).

Second, a between-language syntactic priming effect may provide evidence that the first language can help acquire sentence structures of the second language. For example, a Chinese to English syntactic priming effect may suggest that the Chinese sentence structure can facilitate the production of the English sentence structure. In another sense, teachers can help students develop abstract syntactic representation with the aid of Chinese structures, which can reduce students' cognitive load in representing and processing English sentence structures.

Contributions to syntactic priming research. Although syntactic priming has become an interdisciplinary research field and has developed its own experimental paradigms, there are still gaps in the research, particularly in China (Hung, 2011; Wang, 2015). This study, therefore, will contribute to the syntactic priming research in the following ways.

First, this study will offer insights into whether the stability of priming effects in college-level second language learners shown in previous research can be generalized to second language learners at the high school level and whether the distance between L1 and L2 will lower the effects. Second, this study may provide supportive evidence for the controversial issues about how second language proficiency affects the strength of the priming effect, whether positively or negatively.

Outline of the Thesis

This thesis consists of six chapters. Chapter 1 describes the research background and the research significance. The research background involves syntactic representation and the syntactic priming phenomenon. The research significance was presented from three perspectives, including the mental representation of syntactic information, second language acquisition, and syntactic priming research.

Chapter 2, the literature review, includes the following sections: a description of the relevant concepts and theories and a review of the literature. The review highlights the role of syntactic structures in the language system and demonstrates the value of researching syntax. Comparisons between Chinese and English syntactic structures will also be made. Next, the account of syntactic representation and the relevant theoretical assumptions will be provided. Then, syntactic priming effects, a tool to probe into syntactic representation, will be introduced and include a discussion of the types of priming effects. What follows is the overview of previous syntactic priming research. Subsequently, the review will focus on the developmental models for bilingual representation and on previous studies of bilingual syntactic priming in the Chinese context and more broadly across countries. Finally, the review will discuss research of syntactic priming on Chinese English learners and will highlight limitations of previous research.

Chapter 3 presents the empirical study for the thesis. The chapter begins with the research focus, research questions, and research hypotheses. Then, the research design, method, and procedure will be discussed. The final part of chapter 3 includes

the scoring and data calculation, which will explain how the raw data were dealt with.

Chapter 4 provides an explanation of the data analysis and presents the results.

Chapter 5 discusses the results. Finally, chapter 6 presents the major findings of this study, followed by theoretical and pedagogical implications. The thesis ends with a discussion of the limitations and suggestions for future research.

Chapter 2 Literature Review

Syntactic priming manifests as the reuse of a type of syntactic structure after exposure to it, as opposed to the use of an alternative structure. As this study involves English and Chinese syntactic structures and aims to figure out the syntactic representation of Chinese English learners through conducting priming research, the literature review will provide an overview of syntactic structure, syntactic representation, priming effects, and previous studies of syntactic priming.

Syntactic Structure

Roles of syntactic structure in the language system. Language production is closely related to sentence structure. Whenever people talk or write, they need to produce syntactic structures. Regardless of the language, people can create an infinite number of sentences with a limited number of syntactic structures. A syntactic structure contains abstract rules by which words combine to form phrases or sentences and by which individuals can communicate with each other and express their thoughts. Someone might produce or understand a completely new sentence which they may never before have produced or heard by means of syntactic rules. Syntactic structure belongs to the grammatical system, which constitutes a major aspect of the language system (Poole, 1999).

The importance of syntactic structures is also seen when beginning second language learners may understand every single word of a sentence but still find it difficult to understand the meaning of the sentence. The reason for this is likely due to their limited syntactic knowledge. Similarly, beginners may have a large vocabulary;

however, they still might find it difficult to produce sentences. This situation may be even more difficult for second language learners who are learning a second language that is distant from their first language, such as Chinese and English (Chinese belongs to the logographic writing system whereas English belongs to the alphabetic system).

Syntactic differences between Chinese and English. Chinese belongs to the Sino-Tibetan language family and English belongs to the Indo-European language family. Since Chinese and English belong to different language families, there are many syntactic differences between the two languages. The greatest syntactic differences between Chinese and English are hypotaxis and parataxis. In other words, English emphasizes formal cohesion while Chinese emphasizes semantic cohesion (Xin, 2008). The formation of English sentences involves morphological changes whereas the formation of Chinese sentences mainly relies on the changes of word order. Consequently, it is quite common for beginning Chinese English language learners to produce sentences without inflections or conjugation, such as in “We have two apple” or “He open the door”.

English is a subject-prominent language while Chinese is a topic-prominent language (Yang, 2002). The syntactic structure of a subject-prominent language is subject-predicate, such as, “The sky is blue”. The syntactic structure of a topic-prominent language is topic-comment, such as in Chinese “这天真蓝”, which literally means “The sky really blue” without a predicate as in English.

Syntactic similarities between Chinese and English. Despite the great syntactic differences caused by different language families, Chinese and English have some syntactic similarities. First, from a broad perspective, the basic sentence structure of Chinese and English are both “subject verb object” (Zhang, 2008). More specifically, Chinese and English share several types of sentence structures, such as ditransitive and dative constructions.

Syntactic similarities between two languages will influence the second language learner’s syntactic process and representation. The more similar two languages are in certain aspects of syntax, the closer the syntactic representations of the two languages (Yu, 2016). Guo and Chen (2009) found that the experience of one’s native language will influence the processing of learning a second language. Given the differences as well as similarities between Chinese and English, there is a growing interest in examining how these two languages interact with each other and how they are represented in the mind.

Syntactic Representation

Defining syntactic representation. Syntactic representation is an abstract concept and refers to the manner that language users (including monolinguals and bilinguals) store or process their syntactic knowledge in their mind (Hartsuiker & Pickering, 2008; Pickering & Branigan, 1998). The syntax of the first language is usually more established than the second language. Thus, it is believed that L1 syntactic information is stored in a more abstract way than L2 syntactic information (Hartsuiker & Pickering, 2008; Hartsuiker & Bernolet, 2017). Also, the mental

representation of L1 syntactic information has reached a highly abstract level. This enables individuals to produce a new sentence effortlessly. Conversely, L2 production takes greater efforts for L2 beginners. The unbalanced state of L1 and L2 has raised the question of how bilinguals store the syntactic information of two languages, whether it is completely separate or partly shared (Hartsuiker, Pickering, & Veltkamp, 2004). Some researchers assume that bilinguals have two completely separate representations for the syntactic information of two different languages (e.g., Vigliocco & Hartsuiker, 2002). In contrast, other researchers support a shared-syntax representation (e.g., Hawkins, 1988). These researchers believe that bilinguals might have a single representation for similar constructions from different languages. For example, Chinese “给我展示一本书 (show me a book)” and English “give him a pen” share the construction of the double objects “verb noun noun”.

The issue of bilingual syntactic representation is complicated by the different degree of the similarities and differences of two languages, a variety of different parallel structures of the two languages and different second language proficiency. Existing syntactic studies have therefore targeted different structures, languages, and populations in an attempt to generalize syntactic representation.

It is worth noting that the abstractness and the unobserved characteristics of the syntactic representations have contributed to challenge of investigating syntactic representation and reliable research methodology is limited (Song & Do, 2018). Nevertheless, researchers have proposed following theories about bilingual syntactic representation.

Theories of syntactic representation.

The separate representation theory. The separate-syntax-representation theory proposes that bilinguals have a completely separate representation for the syntactic knowledge of different languages, including the separate representations for the similar syntactic constructions of two languages (Vigliocco & Hartsuiker, 2002). For example, Chinese constructions “给某人某物” (English translation equivalent: give sb sth) and English construction “show sb sth” are represented separately. According to the separate representation account, even though the syntactic constructions are similar across different languages, as long as they have a different language system it is possible that other aspects may block the integration of similar or identical constructions (e.g., different surface word order and different frequency of use).

The shared representation theory. The shared-syntax-representation theory proposes that bilinguals have a single representation for the similar syntactic structures from different languages (Hawkins, 1988). Compared with the separate representation, it is believed that the shared syntactic representation involves less storage space and lower cognitive loads for individuals to represent and process bilingual syntax (Hartsuiker & Pickering, 2008). The reasons are as follows. First, second language learners do not need to separately store similar syntactic constructions from different languages. Second, under the circumstance of the shared representation, processing a sentence structure of one language would facilitate the reuse of the sentence in the other language with the residual activation occurring earlier (Hartsuiker & Pickering, 2008). Also, bilinguals can use their L1 syntactic

knowledge to assist with L2 production (Hartsuiker & Pickering, 2008).

Priming Effect

“Priming refers to facilitative effects of an encounter with a stimulus on subsequent processing of the same stimulus or a related stimulus” (Tulving, Schacter, & Stark, 1982, p. 336). In the context of language research, priming refers to the phenomenon where an individual’s previous language experience can facilitate their subsequent processing of language, manifesting in the form of recognition of meaning or production of a form (McDonough & Trofimovich, 2009). In addition to referring to cognitive processes, priming can also refer to a psycholinguistic method or an experimental procedure (Pickering & Ferreira, 2008).

Rationale for the priming effect. Priming is a kind of nonconscious memory (Tulving & Schacter, 1990). Specifically, priming is a form of implicit learning in which people remember the abstract concepts incidentally, such as the abstract language form or semantic aspects, with little awareness during the process of language use. When a stimulus associated with the abstract concept occurs and the concept is previously stored in people’s mind, the incidentally-learned abstract concepts are likely to be activated by the stimulus. The stimulus becomes a facilitator for the mental process, such as facilitating the production of the language form or facilitating the process of the associated meaning (Tulving & Schacter, 1990). Priming is nonconscious memory and cannot be directly perceived or observed. Therefore, researchers try to study it through experimentation.

Priming has become a tool to probe into the mental representation of language

knowledge because priming is believed to be able to tap into the abstract linguistic knowledge. Branigan, Pickering, Liversedge, Stewart, and Urbach (1995) believed that if processing a stimulus can influence or modify the processing of another stimulus, then there must be a relationship between the two stimuli over a dimension. To take syntactic priming as an example, if exposure to one sentence which contains a particular type of structure (e.g., give sb sth) can induce second language learners to produce the same structure (e.g., show sb sth) rather than the alternative type (e.g., show sth to sb) within languages or even across languages, this can suggest that second language learners can store syntax in an abstract way (e.g., Verb NP NP) instead of representing the concrete constructions one by one.

Types of priming effects. Priming effects have been employed in a variety of research fields. As Pickering and Ferreira (2008) suggested, priming occurs in most or all levels of language representation, including semantic priming, syntactic priming, and auditory priming. The following sections discuss the most typical priming effects: semantic priming and syntactic priming.

Semantic priming. As the term implies, semantic priming is a kind of priming effect related to aspects of semantics. An encounter with a particular meaning in language can speed up the recognition of a word with a similar or related meaning. One of the typical examples of semantic priming is that people who see the word “nurse” will recognize the word “doctor” faster than those who see the word “bread” (Meyer & Schvaneveldt, 1971). This makes sense given that the word “nurse” and the word “doctor” are semantically related. This leads to quicker lexical access in

people's mind. This is in contrast with "bread" and "doctor", which are typically unassociated.

Syntactic priming. Unlike semantic priming, syntactic priming refers to a priming effect that occurs on the syntactic level and independent of meaning. Syntactic priming refers to the phenomenon that encountering a language form motivates individuals to produce the same form rather than an alternative form. In contrast with semantic priming which focuses on meaning, syntactic priming only emphasizes the syntactic structure. As previously mentioned, priming involves nonconscious memory. Therefore, syntactic priming is distinguished from deliberate imitation of oral or written production, such as consciously copying the sentence structure used by others. Syntactic priming is much more related to implicit learning than explicit learning. This will be further discussed below.

Experimental paradigms of syntactic priming. Over the past few decades, several typical experimental paradigms have been developed and widely used in research investigating syntactic priming phenomenon in production. These are the picture description task, the sentence completion task, and the sentence recall task (Feng, Chen, Feng, & Feng, 2014; Jia & Chen, 2009; Wang, 2015). In essence, all three paradigms follow the same logic. First, study participants are exposed to the priming sentences which contain a specific type of syntactic structure. Participants process the sentence by either hearing, repeating, or completing sentences. Then, the experimenter uses a task to elicit participants' production. Finally, the priming effect occurs for those participants who tend to choose the target structure in the production

rather than an alternative structure.

There are several requirements that should be considered in the design of a syntactic priming experiment. This is because syntactic priming involves a selection process between sentence structures without participants' awareness (Feng et al., 2014). First, the experimenter does not inform the participants that it is a priming study because what the experimenter expects to test is participants' unconscious production. Instead, the experimenter may inform participants that they will test their English proficiency or comprehension ability. Second, in addition to priming and target sentences, filler materials are used and randomly spread between prime-target pairs. This is to disguise the purpose of the experiment. Third, syntactic priming research always selects sentence structures with alternates as priming structures, like actives and passives and DO and PO (McDonough & Trofimovich, 2009).

McDonough and Trofimovich (2009) suggested the number of priming-target and filler sentences will depend on the participants and their proficiency levels. They recommended using as few as five prime-target pairs and no filler sentences if syntactic priming research is targeting young L1 children. This is due to children's limited attention span and limited level of cognitive development. As for syntactic priming research investigating L2 beginner or low-intermediate learners, McDonough and Trofimovich (2009) recommended using fewer priming sentences and filler sentences to reduce the linguistic demands and cognitive load of the task.

The picture description task. The picture description task was created by Bock (1986). During the task, participants listen to a sentence which contains a particular

syntactic structure and repeat it; then, they are asked to describe a picture with a sentence. The picture has no semantic relationship with the priming sentence and could be described with two alternative structures, such as passive or active voice. To mimic a real conversational context, Hartsuiker, Pickering, and Veltkamp (2004) developed another form of the picture description task, called the confederate-scripting technique. In this task, one participant is asked to pick out the pictures described by another participant, who is a confederate of the experimenter; then, in turn, the participant describes the picture. If most of the participants use the structures they heard from the confederate, syntactic priming effect has occurred during the interactive conversation.

The sentence completion task. This task was created by Pickering and Branigan (1998). They used this task to investigate the syntactic priming effect in written language production. During the task, participants complete sentence fragments. Fragments consist of priming and target fragments. The priming fragments have been manipulated by the experimenter so that the possible answer is grammatically limited to a particular type of sentence structure as opposed to an alternate. For example, in the priming fragment, “The old man showed the picture...”, participants would likely complete the sentence with the prepositional object (henceforth PO), e.g., “to the girl”; they may use another structure, such as “he bought yesterday”, but grammatically speaking, they cannot fill in the double objects. Conversely, in the fragment “The clerk sold him...”, participants cannot fill in a prepositional structure since this is grammatically incorrect. Instead, they must use a double object

construction, e.g., “the picture”. Immediately after the priming sentence, participants are asked to complete a target sentence which contains a subject and a verb, such as “his father sent”. Thus, in the target sentence, participants are not limited in the usage of PO or DO structures. If participants tend to use the structure of the priming sentence, one can conclude that the structural priming effect has occurred.

Additionally, there will normally be two to four filler sentences between prime-target pairs to disguise the purpose of the experiment. If the participants use an “Other” response in the priming fragments, that sentence will be omitted in the analysis since it does not work as a stimulus in the experiment. “Other” responses in the target fragment will be omitted too because the data analysis will only compare the amounts of the target structure and its alternate in production.

The sentence recall task. Another typical task used to examine the syntactic priming effect is the sentence recall task, which was developed by Potter and Lombardi (1990). This task uses the rapid serial visual presentation technique, in which participants first see a target sentence which is presented rapidly word by word (100 milliseconds per word). Then, participants read a complete priming sentence and recall it. Finally, participants recall the target sentence which can be expressed with two alternative structures. The structures of prime and target sentences are different but in an alternative relationship, such as DO and PO. If the structure in the prime affects the recall of the target sentence, then the syntactic priming effect has occurred. For example, the target sentence uses the PO structure, but DO prime causes participants to recall the target sentence with the DO structure rather than with the PO

structure. That means the previous stimulus has influenced participants' subsequent recall.

The rationale for within- and between-language syntactic priming. In the experimental context, syntactic priming refers to the phenomenon that the sentence structure which participants use to complete the priming sentence will lead participants to subliminally use the same sentence structure instead of the alternative structure to complete the target sentence. As the name implies, within-language syntactic priming means that the language of the priming sentence and the language of the target sentence are the same. For example, processing double objects (henceforth DO) in English could lead participants to produce more double objects in English (Pickering & Branigan, 1998). Between-language syntactic priming means that the priming sentence is in one language and the target sentence is in a different language. For example, Kantola and van Gompel (2011) found that exposure to double objects in Swedish could lead participants to produce more double objects in English.

The within-language syntactic priming effect is attributed to the activation of abstract syntactic information. Within a single language, some structures are semantically unrelated but share the same abstract representation, such as "My friend gave me a book" and "The student sent him a paper". These two sentences share the abstract rule "Noun Verb Noun Noun". Generating a sentence structure of this kind can activate the abstract representation of the similar syntactic structures, resulting in a lower threshold for the reuse of that kind of sentence structure compared with the

use of the alternative structures. If people are less familiar with the concrete structure, they may be unable to form the abstract rules, in which case the storage of “give sb sth” and “show sb sth” are separated for them and the representation of the abstract rule “Noun Verb Noun Noun” is cognitively not well-established. Within-L2 syntactic priming relies on abstract syntactic similarities and requires formation of abstract representation for similar structures. In turn, the occurrence of within-language syntactic priming indicates that people have formed an abstract representation for the similar syntactic structures within the language.

The rationale for between-language syntactic priming is as follows. If the syntactic representation of two languages are shared, processing one language syntactic structure will prime or facilitate the processing of another language syntactic structure. In other words, shared representation predicts between-language syntactic priming effect. However, if the syntactic structures of the two languages are represented separately, producing a sentence structure of one language would not prime the production of the same sentence structure in a different language. Namely, separate representation predicts the nonoccurrence of priming effects across languages (Desmet & Declercq, 2006; Hartsuiker & Bernolet, 2017). In turn, if the production of a sentence structure in one language can prime the production of the same structure in the other language, then the two languages must be syntactically related to each other. Therefore, the syntactic priming effect across language reflects the shared representation, at least to some degree.

According to the sequence and the rules of language development, Hartsuiker and

Bernolet (2017) assumed that before developing a shared representation across languages, people tend to go through an abstract representation for the similar structures within language, namely language-specific representation. In light of that, people who show a within-language syntactic priming effect may not necessarily show a between-language one if they are still separately storing similar sentence structures from different languages.

Moreover, if the within-language syntactic priming effect is equally as strong as the between-language syntactic priming effect, then the syntactic representation of the two languages has become fully integrated (Kantola & van Gompel, 2011). All in all, syntactic priming predicts syntactic representation, and in turn, syntactic priming reveals syntactic representation.

The mechanisms of syntactic priming.

Lemma node activation model for bilinguals. Drawing on Pickering and Branigan's (1998) activation model, which was put forward on the basis of findings from monolinguals and only involved within-language representation, Hartsuiker, Pickering, and Veltkamp (2004) extended the model to bilinguals' cross-linguistic syntactic priming. This is shown in Figure 2.1 (from Hartsuiker & Bernardo, 2017). The extended version for bilinguals involves verbs from different languages. For example, the word "give" in English and "geven" in Dutch are both connected to PO construction and DO construction. This suggests that while they are from different languages, the lemma nodes of the two words share the combinatorial nodes. This model can therefore reflect a shared-syntax representation of two languages in second

language learners' minds. Hartsuiker and Bernolet (2017) pointed out: “a shared syntax account would predict structural priming across languages” (p. 221).

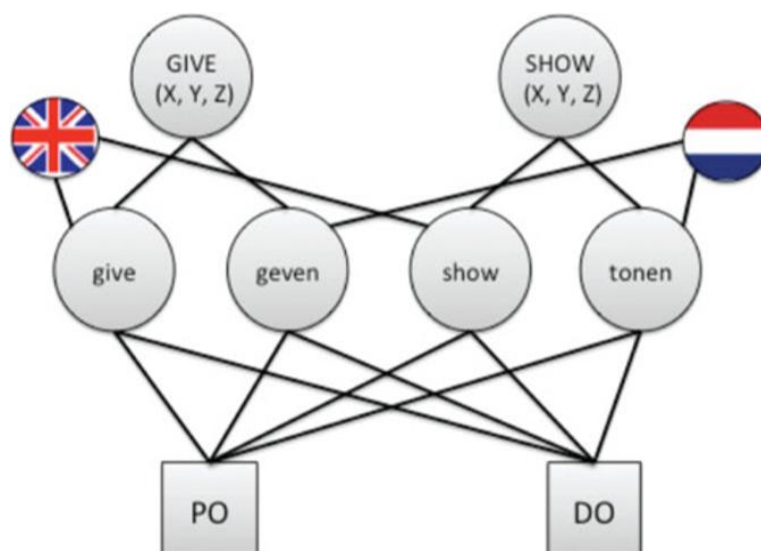


Figure 2.1. Fragment of the adaption of the activation model by Hartsuiker et al.

(2004) and Schoonbaert et al. (2007). The flags represent language nodes for English and Dutch respectively (from Hartsuiker & Bernolet, 2017).

Implicit learning. Bock (1990) noted that syntactic priming takes place when participants are unaware of the target structure. Regarding the account of syntactic priming phenomenon, Bock and Griffin (2000, p. 177) compared implicit learning and transient memory. They concluded that although explicit memory may have a short-lived influence on the part of the syntactic priming phenomenon, the persistence of syntactic priming effect is more associated with implicit learning than short-term memory. They considered syntactic priming as a process of implicit learning during which participants adjust their language processing system by virtue of previous experience. Bock and Griffin (2000) supported their conclusion with the

characteristics of implicit learning that Seger (1994) summarized: “(a) not fully accessible to consciousness, (b) fairly complex and abstract, (c) an incidental consequence of some task performance, and (d) preserved in cases of amnesia” (Bock & Griffin, 2000, p. 179). Bock and Griffin (2000) held that structural priming satisfies all of these characteristics. Additionally, Ferreira, Bock, Wilson and Cohen (2005, 2008) found that syntactic priming effect occurred in amnesiacs who suffered from a loss of memory. This provided support for the view that syntactic priming occurs through implicit learning.

To note, Pickering and Ferreira (2008) did not think lemma node activation model and implicit learning account are antithetical to each other.

An Overview of Syntactic Priming Studies

Syntactic priming has been researched for decades (Bock, 1986). Researchers first found the existence of a syntactic priming effect through natural observations of people’s daily conversations (e.g., Kempen, 1977). In 1986, Bock became the first to demonstrate the existence of the syntactic priming effect via experiments. She used a picture description task, which has become a typical paradigm in the area of syntactic priming research.

Syntactic priming research has continued to develop since Bock’s research (1986) and appears to have rapidly expanded, especially around and after the turn of the 21st century. The discovery of the occurrence of syntactic priming has increasingly spread from production to comprehension (e.g., Arai, Gompel & Scheepers, 2007), monolinguals (e.g., Pickering & Branigan, 1998) to bilinguals, within languages (e.g.,

Pickering & Branigan, 1998) to across languages (e.g., Loebell & Bock, 2003), and in a single domain in which language primes language to across domains in which mathematics primes the production of sentence structures (e.g., Nakai & Okanoya, 2018; Scheepers & Sturt, 2014). For instance, psycholinguistics most often use syntactic priming to probe into the mental representation of the syntactic structures, whereas linguists use syntactic priming to investigate early language development and second language learners. Researchers interested in second language acquisition have used syntactic priming to explore its value in improving second language learning via conducting interactive activities in the classroom. Some researchers have used syntactic priming as a treatment for aphasia and found that it could help aphasics recover languages (e.g., Lee & Man, 2017).

In terms of research methods of syntactic priming, other than the behavior studies (e.g., experiments using typical paradigms as introduced earlier, eye-movement experiments and self-paced reading experiments), researchers have adopted other techniques, including fMRI (functional magnetic resonance imaging) (e.g., Nakai & Okanoya, 2018), ERP, corpus-based (e.g., Gries & Kootstra, 2017), and classroom-based research (e.g., McDonough & Chaikitmongkol, 2010; Shin & Christianson, 2012).

The current study used the method from behavior studies to conduct both within- and between-language syntactic priming in production. The primary aim of the current study was to explore the syntactic representation and inform second language development. A secondary goal was to provide pedagogical implications for second

language teachers.

Because this study investigated syntactic priming effects in production rather than comprehension, all the subsequent literature and examples are targeted to syntactic priming research in production. Moreover, this study targeted bilingual syntactic priming rather than monolingual priming, and thus the following literature review focuses on bilingual studies.

Bilingual Syntactic Representation and Bilingual Syntactic Priming

Defining bilingualism. The definitions of bilingualism are diverse. Broadly, researchers use bilingualism to refer to the use of two languages without taking other factors into consideration. For example, according to Macnamara (1967), people are bilingual as long as they have a minimum grasp of one of the language skills (listening, speaking, reading, writing) of a second language. Bilingualism is also defined as the use of two or more than two languages (Grosjean, 1982). More specifically, researchers have defined bilingualism as using two languages fluently. Paradis (1986) insisted that bilingualism refer to the use of two languages and that the second language must reach an almost native-like level. Romaine (1995), however, disagreed with this strict definition because in actuality there are very few people who have nearly equal command of two languages.

With respect to syntactic priming research, definitions of bilingualism have also ranged. Some researchers interpret bilingualism as the use of two languages irrespective of the proficiency gap between the two languages, and therefore they use *bilingual* to replace *second language learner*. However, others have defined

bilingualism as the proficient use of two languages. This study has adopted a broad definition of bilingualism, namely those who possess the minimal knowledge of two or more languages.

Developmental models of bilingual representation. In recent years, researchers (Bernolet, Hartsuiker, & Pickering, 2013; Hartsuiker & Bernolet, 2017) have created two developmental models to account for how second language learners develop syntactic representation for different languages. Both models target bilinguals, with the more recent developmental model referring to both L2 within-language representation and L1-L2 between language representation. The intent of the extension in the more recent developmental model was to explore the bilingual syntactic representation in the course of L2 development. Although the developmental model still needs empirical research, results from previous studies on bilingual syntactic priming have provided some support for the developmental model (e.g., Kim & McDonough, 2008; Hartsuiker et al., 2004). This is because previous research results are mixed and inconsistent. This implies that it is feeble to merely use either the single-syntax or the shared-syntax proposal to account for syntactic representation. The syntactic representation is thus more likely to be developmental. A critical point reflected throughout the developmental models is that the strength of the syntactic priming effect may be closely associated with second language proficiency. The developmental model also suggests that bilingual syntactic representation is an ongoing process. The following section provides an overview of these two developmental models for bilingual syntactic representation.

The early developmental model. The model proposed by Bernolet et al. (2013) began with their analysis of research conducted by Hartsuiker et al. (2004). Bernolet et al. (2013) argued that the shared-syntax model proposed by Hartsuiker et al. (2004) is probably the final stage of second language learners' syntactic representation. This is because the shared-syntax model by Hartsuiker et al. (2004) is based on research targeting advanced English learners whose second language proficiency (English) was at a medium-high level. These English learners had almost equivalent proficiency between their second language and their first language (Dutch). Bernolet et al. (2013) further argued that before two different languages develop into a shared syntactic representation, second language learners should experience a stage of language-specific representation. To take Chinese English learners as an example, when proficiencies between L1 and L2 are unbalanced, Chinese English learners' abstract representations exist only within Chinese or within English. In other words, shared representations across languages have not yet formed, with the representation for Chinese syntax and that for English syntax being independent of each other and not yet fully integrated. To test their assumption, Bernolet et al. (2013) recruited both low- and high-proficiency English learners to participate in a Dutch-English syntactic priming study. Their findings showed that in the within-language (English-English) experiment, both low and high English level participants showed priming effects, whereas in the cross-language experiment, only high English level participants showed a priming effect. Bernolet et al. (2013) suggested that these differences were due to the different representation stages of participants, which were associated with

their second language level. Bernolet et al. (2013) also suggested that the reason why low English level participants showed priming effects in the within-language but not across languages was because that the participants have only formed the abstract representation within English and have not yet formed a shared representation across Dutch and English. On the contrary, high English level participants who did show priming across languages may have formed shared representations. Therefore, Bernolet et al. (2013) concluded that bilinguals' syntactic representation develops from a language-specific stage to an abstract and shared stage. Accordingly, Bernolet et al. (2013) proposed a developmental model to illustrate bilinguals' syntactic representations developing from a separate representation to a shared representation, as shown in Figure 2.2.

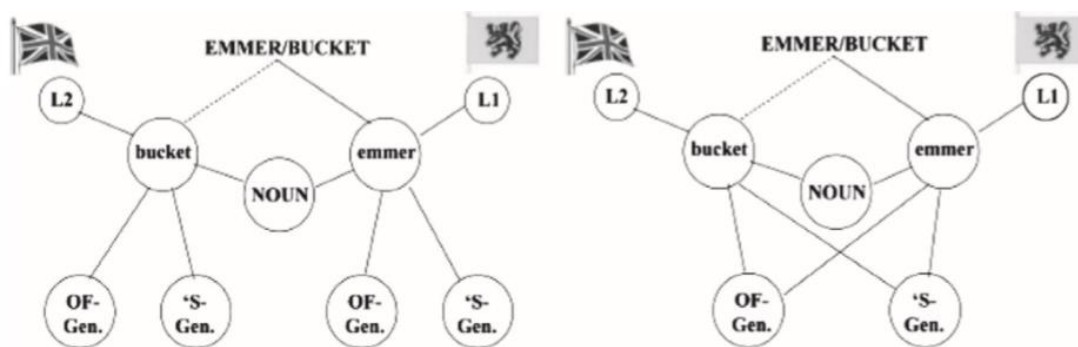


Figure 2.2. A developmental model for late bilinguals' syntactic representation (Bernolet et al., 2013). The flags represent language nodes for English and Dutch respectively.

The newly-proposed developmental model. By reanalyzing their previous studies as well as their earlier models (Hartsuiker et al. 2004; Bernolet et al., 2013), Hartsuiker and Bernolet (2017) proposed a new developmental model. This model is a

continuum of five panels and accounts for how syntactic representation develops during the course of second language acquisition (see Figure 2.3). Like Bernolet et al. (2013), Hartsuiker and Bernolet (2017) suggested that bilinguals need to go through a language-specific representation before reaching a shared representation. That is, representation of each language is independent of each other before they integrate into one. Hartsuiker and Bernolet (2017) argued that the development of bilinguals' syntactic representations should be on a continuum. Therefore, they sketched five panels to specify the consecutive stages, with each panel corresponding to each stage. Panel 1 in Figure 2.3 represents the initial stage in which researchers hypothesized that second language learners have successfully acquired their first language.

Before forming the abstract representation of syntactic information in L2 (as in panel 4), learners may need to go through three stages. In panel 1, verb nodes in L1 (first language) are linked to combinatorial nodes. This indicates that learners have obtained corresponding syntactic information for the verbs. For example, at this stage, Chinese English learners can understand how to use 给 in 给某人某物 (which means *give* in “give sb sth”) in their L1. Also, the combinatorial nodes are shared between the two verbs. That means, for instance, Chinese English learners have understood that 给 and 展示 (which means *give* and *show*) share the same structure “Verb NP NP”. Thus, one can expect the occurrence of syntactic priming within L1 (Chinese in the example) at this stage. However, learners still have not formed syntactic representation in L2 at this initial stage. That means that even if a second language learner knows the word *give* in L2, he/she still cannot use the verb

give with “NP NP” spontaneously. In this case, Hartsuiker and Bernolet (2017) suggested that when asked to complete the target sentence in a within-English (L2) syntactic priming study, a participant may finish the target sentence (e.g., The man gave...) by transferring the syntactic information from their native language or just by imitating the L2 structure they have recently heard or read. At stage 2, learners’ L2 syntactic information begins to gradually increase and starts to make connections with lexical nodes. For example, second language learners may be able to produce the construction *give sth to sb*, but still cannot produce the construction *give sb sth*. At stage 3, learners have obtained all the syntactic information for different verbs in L2, yet the verbs remain separately represented and processed. At stage 4, the representation of syntactic information in L2 becomes shared. Thus, one can expect the occurrence of syntactic priming within L2.

At stage 4, the syntactic representation for two different languages is still separate and language-specific. At the final stage, when learners’ second language becomes proficient enough, syntactic representations for L1 and L2 structures integrate into one representation. Thus, at stage 5, one can expect learners to have syntactic priming across languages. In the case of fully shared syntax, one can even expect that L2 within-language priming and L1-L2 between-language priming will be of equal strength.

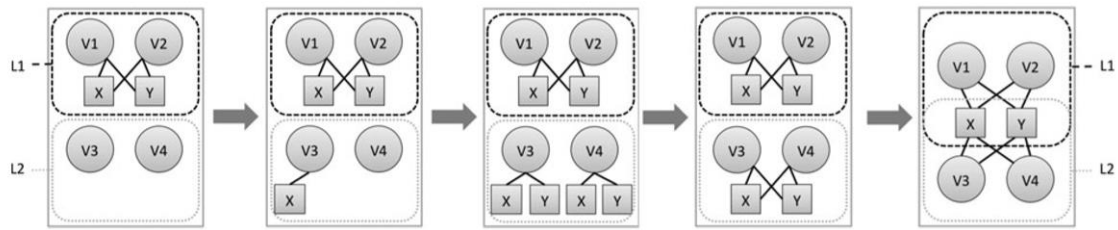


Figure 2.3. The developmental model (Hartsuiker & Bernolet, 2017). V represents verbs. X and Y represent combinatorial nodes.

Previous bilingual syntactic priming studies. Between-language syntactic priming effects have increasingly been studied across a variety of languages, for example between English and German bidirectionally (Loebell & Bock, 2003), from English to Spanish (Hartsuiker, Pickering & Veltkamp, 2004), between Dutch and English (Desmet & Declercq, 2006; Schoonbaert, Hartsuiker & Pickering, 2007), from Korean to English (Shin & Christianson, 2009), and between Chinese and English bidirectionally (Hung, 2011). Moreover, the ways that researchers expose participants to certain sentence structures are diverse, ranging from listening and repeating (Bock, 1986), dialogue (Branigan, Pickering & Cleland, 2000), to oral or written sentence completion (Cleland & Pickering, 2006).

Despite support for the occurrence of syntactic priming across languages, it does not happen all of the time. For example, McDonough (2006) only observed the syntactic priming effect in prepositional objects and did not observe the effect in double objects. Most participants were Chinese university students who were studying in the United States. As Wang (2009) commented, syntactic priming is not a stable phenomenon and relies on the specific experimental condition. It is also influenced by the degree of the abstract representation and frequency of exposure to the structures.

To gain a greater understanding of the nature of syntactic priming and its association with syntactic representation, research has been conducted on a wide variety of factors that may influence syntactic priming effect. The following is an overview of previous bilingual syntactic priming research.

Factors influencing bilingual syntactic priming.

(1) Lexical repetition. Lexical repetition means to repeat words (always the verb) in the priming sentence and the target sentence (Pickering & Branigan, 1998). For example, if the priming fragment is “The old man showed the photo...”, under the lexical repetition condition, the target fragment will be “The driver showed...” rather than “The driver sent....”. Pickering and Branigan (1998) were the first to demonstrate that lexical repetition could strengthen structural priming effect. As a result, they called this event a lexical boost. Many studies have since demonstrated that a lexical boost occurs in both monolinguals and second language learners (e.g., Cleland & Pickering, 2003; Schoonbaert et al., 2007). Mahowald, James, Futrell, and Gibson (2016) performed a meta-analysis of previous syntactic priming research between 1986 and 2013. By extracting and analyzing the effect size for all experiments, Mahowald et al. (2016) concluded that: “a construction X which occurs 50% of the time in the absence of priming would occur 63% if primed without lexical repetition and 77% of the time if primed with lexical repetition” (p. 5). This means that lexical repetition can make syntactic priming effect increase by 14%. For example, compared with the case in which the priming and the target sentence use different verbs (e.g., *give* and *show*), the PO construction, verb NP NP, will occur 14% more often if both

the priming and target sentences use the same verb either *give* or *show*. One disadvantage is that the lexical boost effect declines quickly (Branigan & McLean, 2016).

(2) Different word order. If investigating syntactic priming across languages, one factor which is worthy of consideration is the word order of the syntactic structures from the two languages. Sometimes the same types of construction from two languages may not have the same order. One example is Chinese passives and English passives. The English passive sentence “The cup was broken by the cat”, translates to “杯子被猫打破了” in Chinese (Chen et al., 2013). Literally, the word order of the Chinese passive structure is “The cup *bei* the cat broken”. *Bei* here is a passive symbol in Chinese. In Chinese, the verb *broken* appears at the end, which means that the passive construction in Chinese has a different order than the English one. However, Chen et al. (2013) found that word order does not affect the occurrence of syntactic priming across languages as long as they have the same hierarchical structures. Other studies have also suggested that word order does not affect syntactic priming effect (e.g., Desmet & Declercq, 2006; Shin & Christianson, 2009). In the present study, Chinese and English PO/DO constructions have the same word order, so the present study appears to be free from the impact of word order.

(3) Construction type/sentence structure. The construction types previously tested in second language learners mainly include actives / passives (Chen, Jia, Wang, Dunlap, & Shin, 2013), datives which comprise double objects and prepositional objects (Gunnar et al., 2017), genitives (Bernolet et al., 2013), and relative clauses

(Arai, Nakamura, & Mazuka, 2015). Among these, actives/ passives and datives have been the most commonly tested. The construction types tested in within-language research have been more diverse than those in between-language research. For example, in within-language research, Gompel, Arai, and Pearson (2012) have investigated transitive/intransitive sentence structures (e.g., “He is drinking water” and “He is drinking”); Hartsuiker (1999) has investigated locative inversion (e.g., “Under the chair lies a dog” vs “A dog lies under the chair”). The reason why the sentence structures which can be tested in between-language priming research are relatively limited is that when conducting syntactic priming across languages, structures from two different languages are involved and they should satisfy the requirement of equivalence, such as datives (PO and DO) which can be found in both Chinese and English. Besides, the selected sentence structures should meet the requirement of alternative relationship (e.g., PO and DO, active and passive) to allow researchers to identify participants’ biases in their responses.

While many studies have demonstrated the existence of syntactic priming research across languages, there are still mixed and inconsistent results in terms of how construction types influence the strength of the priming effect. For example, Loebell and Bock (2003) observed cross-linguistic priming effects in both PO and DO structures from German to English and from English to German, but they did not observe effects in the active and the passive voice. This finding may be due to participants’ proficiency, different L1 backgrounds, or participants’ preference for a certain type of structure.

(4) Second language proficiency. Proficiency is another crucial factor that researchers have studied in bilingual syntactic priming research. Hartsuiker and Bernolet (2017) suggested that the degree of abstract representation relies on learners' second language proficiency. Previous research on bilinguals has mostly targeted learners at the university level and there is a lack of research which investigates other levels of learners (Wang, 2015). Previous studies have also tested the strength of the priming effect. Findings show that there are long-lasting effects. Bock and Griffin (2000), for example, found that the priming effect can persist even with 10 filler sentences. Kaschak, Kutta, and Schatschneider (2011) found that the priming effect can endure at least a week. However, participants in studies that show long-lasting effects are all proficient English speakers from high-level American Universities (the University of Illinois and Florida State University). Thus, it is likely that the appearance of strong or long-lasting effects is closely associated with the participants' high proficiency and it may be difficult to occur with participants of low language levels. According to Hartsuiker and Bernolet's (2017) developmental model, the prerequisite for cross-linguistic syntactic priming is that the person has understood how to use constructions in the second language. Thus, Hartsuiker and Bernolet (2017) assumed that beginning second language learners may not show syntactic priming within the second language or across languages because they have not yet formed abstract syntactic representations in their second language.

Overall, findings from previous studies are consistent in terms of the positive role of lexical repetition in syntactic priming effect and no impact of word order on

the priming effect. Yet, there is little agreement on how sentence structure types and language proficiency affect syntactic priming.

An issue about generalization. Many existing studies support the shared-syntax account of the bilingual representation as they have found syntactic priming across languages (e.g., Bernolet et al., 2013; Bernolet, Hartsuiker, & Pickering, 2007; Hartsuiker et al., 2004; Hartsuiker, Beerts, Loncke, Desmet, & Bernolet, 2016; Kantola & van Gompel, 2011). Although most of the existing research that has investigated bilingual syntactic representation has found a shared representation, most studies have focused on students at the university level. The developmental model by Pickering and Bernolet (2017) suggests that the bilingual representation is neither simply a shared representation nor a separate representation. Rather the representation gradually develops from separate to shared. No matter which account, the generalizability is questionable because of the limited scope and the limited amount of existing research.

As described, most of the existing research has targeted university-level bilinguals or proficient bilinguals. As second language proficiency increases, the syntactic representation of the second language learners should develop away from their initial syntactic representation. Syntactic structures are also diverse, and while most of the current research has focused on the following structures, including passives/actives, datives/ditransitive structures, transitives/intransitives, few studies have investigated relative clauses (Bernolet et al., 2007) and genitives (Bernolet et al., 2013). Additionally, there are many language families and a variety of languages.

However, existing bilingual syntactic priming research has mainly focused on Indo-European languages. The syntactic knowledge must vary among language families and vary between different specific languages. A broader context is necessary to fully understand the shared-representation. In addition, whether the developmental view of syntactic representation can be generalized to other languages, such as Chinese and English, still needs further investigation.

Although the existing research has spread to different types of bilinguals around the world, the amount of the research targeting different types of bilinguals is limited. In short, the limited research scope and amount of the existing studies, as well as the inconsistency of the research findings has led to the issue of generalization. As such, more research that targets different populations, sentence structures, and types of languages is needed.

Studies of syntactic priming in Chinese second language learners. By and large, there is a lack of research examining the syntactic priming phenomenon with Chinese EFL learners. Although there is a wide range of research investigating the syntactic priming phenomenon on individuals with different L2 backgrounds, the majority of syntactic priming research outside of China has focused on European languages, especially English. Apart from the geographical separation, this is partly because Chinese and English are distant languages, with Chinese using the logographic writing system and English using the alphabetic system.

Despite the fact that syntactic priming research has been investigated for decades, syntactic priming research on Chinese English learners is still at its initial

stage in China. As Miao (2015) commented, domestic research in the area of between-language syntactic priming is relatively weak due to the lack of attention and understanding. There are only a few peer-reviewed articles in China that have adopted one of three typical paradigms to investigate syntactic priming in production among Chinese ESL learners, no matter within- or between-language priming. For example, some researchers have conducted English-English within language syntactic priming research (e.g., Gu, 2016; Wang & Qu, 2012; Xia & Wang, 2017). Additionally, studies have examined Chinese-English or English-Chinese cross-linguistic syntactic priming (e.g., Chen et al., 2013; Gu, 2016; Hung, 2011; Jiang, 2012; Lei & Wang, 2009; Li, 2006; Zhang & Lu, 2012; Yan, 2011). The most common construction types tested in these studies are passives, actives, and datives (DO/PO).

To my knowledge, and at the time of writing this thesis, there have been no peer-reviewed studies that compare English within-language and Chinese-English between-languages syntactic priming effect in Chinese English learners. This is at both the high school and university levels. The advantage of conducting within- and between language syntactic priming simultaneously on the same participants is as follows. By directly comparing the difference of within- and between- language syntactic priming, we can learn which type of syntactic priming is more prominent or whether they are equally strong. This helps us develop a greater understanding of how two types of syntactic priming might differ and how they relate. Also, because syntactic priming can directly tap into the syntactic representation as described earlier, the comparison makes it possible to analyze whether the representation is related to

language distance and language proficiency. Although peer-reviewed research in this area appears to be nonexistent, some work has been done by Zheng (2013). Zheng (2013) compared English-within language and Chinese- English between language syntactic priming in the structures of DO and PO by inviting undergraduate students and postgraduate students to finish a sentence completion task on a brochure. The author found that high proficiency students were more prominent in both within- and between- languages syntactic priming than low-level under the PO priming condition. Conversely, under the DO priming condition, students with low L2 proficiency showed greater effects in both within- and between- languages syntactic priming than high-level students. As for the participants of the same proficiency, the strength of within-language effects is equal to that across languages. Thus, there were interactions between the type of priming structures and L2 proficiencies. One possible limitation of this study may be with respect to the fact that two nouns were provided after each incomplete target sentence (“the poor singer sold...(guitar/stranger)”). This is different from the original sentence completion design. The intent of making this change might have been to lower the possibility of students producing too many other structures instead of the target structures (DO/PO) in the target responses. However, the sequence of the provided nouns may have increased the possibility of producing more PO structures (e.g., the poor sold guitar to strangers) than DO structures.

Similar to the existing research abroad, an apparent limitation of syntactic priming research in China is that almost all existing research has investigated the priming effect at the university level (Wang, 2015). Only a limited number of studies

have investigated the priming effect at the high school level (e.g., Hung, 2011; Zhang, 2016). Hung (2011) compared cross-linguistic priming effects in two directions, from English to Chinese and from Chinese to English via the immediate spoken sentence translation task on a laptop. All participants were senior two students from a Chinese high school and only one English level was included in the study. The tested structures were English and Chinese PO and DO structures. Hung (2011) found that syntactic priming effect in both directions (from English to Chinese and from Chinese to English) and found that the effect of PO was greater than DO in both types of priming. The main purpose of Hung (2011) was to shed light on the implicit mechanism of the syntactic formation instead of exploring the manner of the mental representation. Thus, Hung (2011) did not compare within-language and between-language or students with different proficiencies. In Zhang's study (2016), both high school and university students were invited to participate in a picture description task with the aim of examining the influence of L2 proficiency (low / high) and the types of sentence structures (passive / active voice) on between-language (Chinese to English) syntactic priming effects. She found that in general, the high-level students showed weaker between-language priming effects than the low-level students. This finding was inconsistent with previous research. The limited number of syntactic priming studies conducted at the high school level suggests that there is an uncertainty about whether previous research results collected from university students can be generalized to high school students.

Most of the research in China has demonstrated an existence of syntactic priming

both within and across languages. However, the results are mixed. In terms of the influence of structures, Wang and Qu (2012), who employed a confederate scripting technique to examine English-English within language priming, found the priming effect in DO structures but not in PO structures. In contrast, Hung (2011), who employed the sentence recall task to examine the cross-linguistic syntactic priming effect, found more substantial priming effects in PO structures than in DO structures. Chen et al. (2013) found cross-linguistic priming effects in both Chinese and English passive and active voice bi-directionally (English primed Chinese and Chinese primed English). Also, in terms of how second language proficiency affects syntactic priming effects, there appears to be a divergence among Chinese researchers. Some researchers (e.g., Wang, 2009; Wang and Qu, 2012; Zhao, 2014) have found that higher proficiency speakers show a greater structural effect, while other researchers (e.g., Li, 2006; Zheng, 2013) have concluded that lower-proficiency speakers show a greater effect. Most research beyond China has found that high-proficiency L2 learners have an advantage of showing syntactic priming effect over the low-level learners. These mixed results suggest that the strength of the priming effect is closely related to the types of syntactic priming research (whether within or across languages), the second language proficiency (high or low), the type of tested constructions, and even the selected paradigms. However, there is limited evidence to conclude how these factors influence the priming effect among Chinese English learners.

Lastly, the aim of most of the existing research by linguistics has been to identify

Chinese English learners' mental representation of syntactic structures. However, most research has only investigated the issue with the shared or separate account and only a few studies have looked at the issue from a developmental perspective (e.g., Zhao, 2014). Zhao (2014) put forward a developmental model specific to L2 representations of English intransitive and transitive structures for Chinese English learners. Zhao (2014) conducted within-English syntactic priming research with freshmen and graduate students from a Chinese university by employing the oral sentence completion task, with the transitive and intransitive structure as the target structures. Findings suggest that the high-English level students had priming effects in both intransitive and transitive structures while the low-English level students only showed priming in the intransitive sentence structure. Thus, the author believed L2 representations of high and low English level students are different and develop as second language proficiency increases. However, Zhao's (2014) research indicated that syntactic representation develops from the abstract stage to a more specific representation. This is in contrast with the developmental view, that representation develops from the specific representation to the abstract representation (Wang, 2009). The author accounted for the discrepancy with the theory of the usage-based approach, which regards the frequency of use as critical in language development. As his research did not involve the investigation of Chinese-English syntactic priming, the author recommended that future research should examine the influence of one's mother tongue on L2. Overall, to my knowledge, the developmental model by Hartsuiker and Bernolet (2017) which involves the representation of both L1 and L2,

have not yet been verified in the existing research.

Summary

Studies of syntactic priming have become a mature research field across disciplines, languages, syntactic structures, populations, and paradigms. Because of the nature of implicit learning and the activation of the abstract syntactic information, syntactic priming has been taken as a reliable tool to understand syntactic processing. It is a tool to investigate the syntactic representation, especially L2 representation. It is also a tool to inform second language development and can be considered a new perspective to understand and facilitate second language acquisition.

The review on previous bilingual syntactic priming studies at home and abroad indicates the following limitations: the lack of research on distant languages; the lack of research comparing English-English and Chinese-English syntactic priming research; mixed research results; the lack of research targeting high school students; and the uncertainty of the plausibility of the developmental model recently proposed by Hartsuiker and Bernolet (2017). These limitations have raised the issue of generalizability of the existing proposals of the mental representation. As such, the current study aims to understand Chinese bilinguals' syntactic representation at the high school level, test the existing proposals for the bilingual representation, and shed light on syntactic priming research in terms of how different factors influence the occurrence of priming effect (including syntactic structures, priming language, and L2 proficiency). Finally, the current study aims to provide implications for bilingual second language acquisition from the perspective of psycholinguistics. Specifically,

the present study used English-English and Chinese-English syntactic priming research in Chinese senior high students who take English as L2. The comparison of English-English and Chinese-English contributes to our understanding of the influence of participants' mother tongue or L2 on L2 syntactic production. Also, the present research involved both low and high English proficiency students to test the developmental view. If the syntactic priming effect is observed in the experiment, then it may provide supportive evidence for the shared representation or for the developmental view of syntactic representation. Also, the occurrence of priming could suggest the use of implicit learning for language teaching.

Chapter 3 Methodology

Research Focus

The present study examined both within-language (English-English) and cross-language (Chinese-English) structural priming effects in senior high school students in China.

The target structure in this study is Chinese and English double objects (DO) and prepositional objects (PO). Selecting DO and PO structures is based on the following considerations. First, the structures used in syntactic priming research should satisfy the alternative relationship, namely, different forms with the same or similar meanings, such as DO and PO, active sentence and passive sentence, prepositive attributive and postpositive attributive. The reason why alternative structures should be used is to allow the experimenter to ensure that participants' biases of using a certain structure during language production results from the occurrence of the priming effect instead of a personal preference for certain structures. Apart from the alternative relationship, if the syntactic priming research is between-language, then the selected structures should be shared across the two languages. The requirement of selecting structures which satisfy the alternative relationship and share across English and Chinese has narrowed the choice of structures for this study. Second, the proficiency of participants and the difficulty of structures need to be considered. Relative clause is one of the most difficult structures for Chinese high school students and may cause difficulty with the sentence completion task. Instead, DO and PO structures are more familiar. Third, there is a wide variety of previous research which

has examined DO and PO structures. This research will act as a guide for reference and comparison. Finally, the dative structure is an important aspect of language during Chinese high school. It is expected that this study will provide some pedagogical implications about how to enhance students' mastery of the dative structures in Chinese high school teaching.

Research Questions and Hypotheses

This study aimed to address the following questions:

1. Will English and Chinese PO and DO structures produce the syntactic priming effect for Chinese English learners?
2. How does Chinese English learners' second language proficiency affect the syntactic priming effect in sentence production?
3. How do the strengths of within-language and between-languages syntactic priming differ and how are within and between-languages syntactic priming related?

Based on Hartsuiker and Bernolet's developmental view (2017), bilinguals' syntactic representation of L1 and L2 and bilinguals' L2 acquisition go through several stages. This is because of the language difference and distance. Stages include item-specific representation within language, abstract representation within language, and shared representation across languages with the improvement of L2. Accordingly, this study has put forward the following hypotheses corresponding to the research questions:

H1: Syntactic priming will occur irrespective of the languages or the structure of primes. In light of the statistically specified indicators or criteria, the occurrence

of the syntactic priming effects will be manifested as follows: completing Chinese DO primes will induce a greater proportion of English DO structures in target responses than completing Chinese PO primes; completing English DO primes will induce a greater proportion of English DO structures in target responses than completing English PO primes; completing Chinese PO primes will induce a greater proportion of English PO target responses than completing Chinese DO primes; completing English PO primes will induce a greater proportion of English PO target responses than completing English DO primes.

H2: There will be a two-way interaction between English language proficiency and priming language, such as those with low English language proficiency will show greater priming within language than across languages, and those with high English language proficiency will show greater priming between languages than within languages.

H3: There will be a stronger main effect of English to English priming than Chinese to English priming. The logic behind this is that according to the stages of bilingual representation assumed by Pickering and Bernolet (2017), the Chinese high school students might have formed an abstract representation within English, but have not formed the shared representation between two different languages due to the limited English level of the participants in this study. Also, in terms of the relationship, if there is no within-language syntactic priming in any group, there will be no between-language syntactic priming effects.

According to the developmental view, between-language syntactic priming

requires shared representation and a demand for higher English proficiency than within-language syntactic priming.

Research Design

The present study compared two types of the syntactic priming effects on Chinese senior high school students through an experiment, including within-language priming effect (English-English / L2-L2) and cross-linguistic priming effect (Chinese-English / L1-L2). The two types of syntactic priming differ in the language of the prime sentences, with one in Chinese and the other in English. However, they are the same in term of the target sentences. In the experiment, the study used a sentence completion task, with the double object and the prepositional object as tested constructions. The experiment adopted a 2 (English proficiency: high / low) x 2 (priming language: Chinese / English) x 2 (priming types: double objects / prepositional object) mixed design. Of those, proficiency was the between-subjects factor; priming language and priming type were the within-subjects factors.

Research Method

Participants. Sixty participants were recruited for the study, consisting of 30 low-English-level students and 30 high-English-level students (28 males and 32 females). Another six students were invited to participate in a pilot study prior to the current study. All participants were senior two students from a high school in Guangzhou, China, who learned English as a second language and most of whom had around eight years of English learning experience. Participants' English level was determined by their scores on a recent English test, collected from their English

teachers. The English proficiency measure (the total score=120 points) includes tests of use of language via multiple-choice grammar items (15 points) and MC cloze (30 points), tests of reading comprehension via multiple-choice item (40 points) and passage completion (10 points), and tests of writing via error correction in an essay (10 points) and essay writing (25 points). The following is the specific procedure of recruiting and selecting participants.

Sampling method. Like a lot of high schools in China, there were 6 classes in senior two in the targeted school, including low-academic-achievement classes (two), regular classes (two), and advanced classes (two). Students were assigned to a class according to their overall academic performance. The sample targeted the low-academic-achievement class and the advanced class rather than the whole grade for the following reasons. First, after negotiation with the school's president, it was suggested that the above sampling method would be more feasible than collecting data from a range of classes. As teachers and senior high students had their own rigid schedules, recruiting students from the low and advanced classes ensured that all students could be assessed at the same time. As two groups of students identified from the low and high academic achievement classes had to significantly differ in English proficiency, participants' English scores were collected from their English teachers before the students were invited to participate. Sixty students were identified in total, with half from the advanced class and half from the low-academic-achievement class. All participants were then distributed into two new groups. Specifically, the English scores of participants from different classes were mixed together, ordered from low to

high, and then divided into two groups. The low proficiency group consisted of 20 students from the low-academic class and 10 students from high-academic class. The opposite occurred for the high proficiency. Grouping participants this way was based on English test scores rather than classes since there could be both high and low English proficiency students in each class.

In addition to participants' English test scores, participants' Math and Chinese scores were collected from participants' teachers. This was done because the initial plan was to narrow the groups' gap in Math and Chinese proficiency to maximize the control of irrelevant variables. T-tests were conducted to examine group differences in terms of English scores, Math scores, and Chinese scores. Table 3.1 shows the mean scores and standard deviations of the two groups across the disciplines. The original total score for each discipline was 150. As shown in Table 3.2, the low-level group and the high-level group showed significantly different English test scores ($t = -9.095$, $P < .001$), with the mean difference up to 19.22. Although the differences between the two groups in Math and Chinese score were also significant, the mean difference between the two groups in these two subject areas were approximately 6.60 and 8.67, much lower than the mean difference in English. Thus, it could be said that the two groups had a large gap in English proficiency; however, there was a small difference in Math and Chinese proficiencies.

Table 3.1

Descriptive statistics of English, Chinese, Math scores for low- and high-proficiency groups

	Pro	N	Mean	Std. Deviation	Std. Error Mean
English scores	low	30	105.017	10.786	1.969
	high	30	124.233	4.195	0.766
Chinese scores	low	30	104.067	10.674	1.949
	high	30	110.667	8.895	1.624
Math scores	low	30	106.133	18.472	3.373
	high	30	114.800	11.938	2.180

Table 3.2

Independent samples test of the group difference in English, Chinese, Math scores

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		<i>F</i>	Sig.	<i>t</i>	<i>df</i>	Sig. (2- tailed)	Mean Difference
English score	Equal variances assumed	8.225	0.006	-9.095	58	0.000	-19.2167
	Equal variances not assumed			-9.095	37.578	0.000	-19.2167
Chinese score	Equal variances assumed	0.920	0.341	-2.602	58	0.012	-6.600
	Equal variances not assumed			-2.602	56.175	0.012	-6.600

Math score	Equal variances assumed	3.134	0.082	-2.158	58	0.035	-8.6667
	Equal variances not assumed			-2.158	49.626	0.036	-8.6667

Questionnaire for sampling purpose. To ensure that the two groups of students only differed significantly in proficiency and not in experience with English learning and their exposure to English, a questionnaire about participants' background information was employed. Few previous studies included a questionnaire like this. The questionnaire was included on the final page of the booklet immediately after the written sentence completion task. The questionnaire consisted of two parts and had two specific purposes. The first section of the questionnaire included demographic information, such as gender, the starting time of formal English learning, language dominance, and any foreign experiences. The second section of the questionnaire included 5-point Likert scale items. These items were used to compare students' English test scores with their self-rated English proficiency. The questionnaire was designed based on Marian, Blumenfeld, and Kaushanskaya (2007) (see Appendix II).

For the Likert-scale items, the students were asked to rate their English proficiency in terms of listening, speaking, reading, and writing ability. After the booklets were collected from the participants, the scores of these four skills were totaled for each participant. The total score was used to indicate each participants' self-rated proficiency. Table 3.3 shows that there was a significant difference between the two groups in terms of the total scores of self-rated English proficiency. Hence,

participants' self-rated proficiencies validate their English test scores. In other words, the participant groupings based on their English test scores are acceptable.

Table 3.3

Descriptive statistics of self-rated scores for low- and high-proficiency groups

	Pro	N	Mean	Std. Deviation	Std. Error Mean
Total scores	Low	30	11.20	2.833	.517
	High	30	13.10	3.800	.694

Table 3.4

Independent samples test of the group difference in self-rated English proficiency

	Levene's Test for Equality of Variances		t-test for Equality of Means			t-test for Equality of Means
	<i>F</i>	Sig.	<i>t</i>	<i>df</i>	Sig. (2-tailed)	Mean Difference
Total scores	2.889	.095	-2.196	58	.032	-1.900
			-		.032	-1.900
			2.196	53.633		

Based on the analysis of the questionnaire, the two groups of participants were similar with respect to their background and academic experience. Except for the first language being Chinese and the second language being English, most of the participants in the present study have used or have some knowledge about other languages or dialects, including Cantonese, French, Korea, Japanese, German and the

dialects Hakka and Chaoshan. Nevertheless, Chinese is the native language for all the participants, ranking in front of English in language dominance. Therefore, no participants were ruled out for different backgrounds. Overall, because low and high English proficiency groups in this study were selected from the same grade in the same school and have similar learning experiences in China, the group difference mainly lies in English proficiency. Thus, the participants satisfy the requirements for this study.

Materials. Since there were two different languages and two types of sentence structures involved in the prime sentences, there were four types of prime sentences (four types of experimental conditions) as the following incomplete sentences show (a1, b1, c1, d1): English DO prime condition, English PO prime condition, Chinese DO prime condition, and Chinese PO prime condition. Regardless of the condition, each prime fragment was followed by a target fragment in English (a2, b2, c2, d2). The following are examples of the prime-target pairs under four conditions (pairs: a1-a2, b1-b2, c1-c2, d1-d2):

(a1) The teacher sent him... (English Double Objects prime)

(a2) The little girl gave...

(b1) The teacher passed a book...(English Prepositional Object prime)

(b2) The father showed...

(c1) 快递员 递给 学生... (Chinese Double Objects prime)

(Pinyin: kuaidiyuan digei xuesheng...)

(English meaning: The postman gave the student...)

(c2) The women lent...

(d1) 秘书 发了一份文件... (Chinese Prepositional Object prime)

(Pinyin: mishu fale yifen wenjian)

(English meaning: The secretary sent a document...)

(d2) The boss offered...

English DO and Chinese DO primes (a1 and c1) contained a subject noun phrase and a dative verb, followed by an indirect object, which induced participants to complete the fragments as DO structure. This is in contrast with the PO primes (b1 and d1) which contained a subject noun phrase and a dative verb, followed by a direct object. This tended to lead participants to complete the fragments as PO structures. Each English target fragment only contained a noun phrase and a dative verb. The English dative verbs used in prime and target included: give, show, send, hand, lend, offer, pass, sell. Pickering and Branigan (1998) described these words as more likely to lead participants to complete sentences with PO or DO rather than other constructions. The dative verbs used in the Chinese primes were translation equivalents of the English ones.

In addition to the experimental fragments, there were four types of filler sentences, including Chinese and English sentences. In reference to the experiment by Pickering and Branigan (1998), the types of filler sentences consisted of: noun

phrases modified by adjectives (e.g., The yellow flower...), noun phrases followed by preposition phrases (e.g., “The book on the desk...”), noun phrases followed by a verb or a verb phrase such as (e.g., “The dog is drinking...”), and noun phrases followed by a verb and a noun phrase or an adjective phrase such as (e.g., “My mom wants me...”). The same held for the Chinese fillers. None of the verbs used in the filler fragments would grammatically elicit the production of PO/DO structures. Aside from verbs, a large number of noun phrases were included in the material. To make the sentences easy to understand and to reduce cognitive load for the participants who take English as the second language, all English noun phrases used in the priming and filler sentences were selected from English textbooks for Chinese junior one to three students and those for Chinese senior one students.

With reference to the suggestions by McDonough and Trofimovich (2009), a total of 40 pairs of prime and target fragments were used in this study. The present study followed this guideline: half of the sentences were Chinese to English prime-target pairs, and the other half were English to English prime-target pairs. Out of each 20 priming fragments, 10 fragments would encourage double objects construction and the other 10 fragments would encourage prepositional object constructions. Thus, there were 10 pairs of prime and target fragments under each priming condition. With regard to the filler sentences, there were 60 English filler fragments and 20 Chinese filler fragments, with one to three filler sentences unequally included between every two prime-target pairs. Either two or four filler sentences were used in the previous studies; the purpose of including an unequal number of filler sentences in this study

was to minimize the possibility that participants may discover the pattern (prime-target pairs) that underlay the experimental materials. There were 160 sentence fragments in total.

Instrument. The instrument used for this study was a booklet, consisting of instructions, the sentence completion tasks, and a questionnaire about participants' background information.

Instructions. Instructions were provided in Chinese on the cover page of the booklet. The instructions included the following detailed information in Chinese: (1) complete the Chinese sentence fragments in Chinese, complete the English sentence fragments in English; (2) complete all the sentence fragments in order; (3) complete the sentence with your immediate response on your mind and finish the task as quickly as possible, as long as it is grammatically correct; (4) you are allowed to ask for the meaning of the word if you do not know it.

The sentence completion task. There were four types of incomplete priming sentences in the sentence completion task, as described in the Materials section. Each participant, regardless of whether they were in the low-level group or the high-level group, was repeatedly tested under all four types of priming sentences (or four experimental conditions), so the experiment was a within-subjects design. To counterbalance the order effect, that is an effect where the former priming effect under one priming condition may weaken the latter priming effect induced by another priming condition in the case of this study, four types of priming conditions (Chinese DO prime, Chinese PO prime, English DO prime, English PO prime) were arranged

into four different orders according to a Latin-Square design. According to Latin-Square, four-orders are normally arranged in the way of the right version in Figure 3.1. However, given the situation where condition A appeared three times after condition B while condition B only appeared once after condition A, some adjustment was made to the regular version for further counterbalance. The four orders on the left side in Figure 3.1 show the final version used in the current study. Each letter represents one type of priming condition; four conditions were arranged into four different orders. In other words, there were four versions of the booklet. Each student was provided with one version.

1. A C B D	1. A B C D
2. B D C A	2. B C D A
3. C A D B	3. C D A B
4. D B A C	4. D A B C

Figure 3.1. Latin Square design (left: the version used by the current research; right: the regular version).

One limitation of incorporating all 160 sentences into one test was that students could fill in the target sentence (e.g., The mother gave...) with one word (e.g., an apple). This could be due to the possibility of getting tired towards the end of the test. If such students only filled in one object in the target responses instead of two objects or one objects followed by a preposition, those responses would be scored as Others rather than DO or PO, although it was likely that the participants initially wanted to use DO or PO. Scoring the responses in that way would inevitably affect the results, at least to some degree. Moreover, students might copy the words from previous materials to complete the target sentence. However, this would not affect data analysis

because in syntactic priming research only the sentence structures produced by participants are analyzed.

Questionnaire. In addition to the written sentence completion task, there was a questionnaire on the final page of the booklet which consisted of two parts for sampling purpose, as described in the Participants section earlier.

Procedure

Pilot study. Before determining the experimental material for the actual study, a pilot study was conducted to ensure that the booklet instructions were clear; students did complete the sentences in order; there were no new words for them and that the sentences were appropriate and the task took approximately 40 minutes to 1 hour. According to the feedback from students who participated in the pilot study, the above criteria were satisfied. It took students about 35-55 minutes to finish the task.

Actual experiment. Each student received one booklet (see Appendix III). Before the participants began the task, the experimenter explained the purpose: to see how well students understand and fill in the incomplete English or Chinese sentences. Participants were given an opportunity to ask questions before beginning. The experimenter then read the instructions and asked students to perform the sentence completion task. At the end of the task, participants were reminded again to complete the questionnaire, which included demographic information, their English learning experience, and their self-rated English proficiency (see Appendix II). Upon completion of the task, each student received a bookmark or a bar of chocolate as a token of appreciation. The task took about 35 to 55 minutes.

The procedures for the pilot study and the actual study were the same.

Scoring and Ratio Calculation

Before conducting the data analysis, participants' responses had to be scored according to certain criteria. Only 40 pairs of priming and target sentence completions needed to be scored; filler sentences were left out because they were only used to disguise the purpose of the study and did not serve as primes.

The criteria for the scoring were as follows. The first step was to score the completed priming sentences as DO (double objects), PO (prepositional object), or Other (neither double object nor prepositional objects), according to the type of structure participants used. Double objects is a type of syntactic structure containing two objects, as in "Mike gave his brother a phone". Prepositional object is the syntactic structure containing one preposition and one object, as in "Mike gave his phone to his brother". If certain priming sentences were scored as Other rather than DO or PO, the priming sentences together with the target sentences that they paired with would be left out from further data analysis because such priming sentences could not prime the target production when they did not contain the expected DO or PO structures. In other words, they were not the actual primes. Second, as for the priming sentences which were scored as DO or PO, their corresponding target productions would be scored as DO, PO, or Others according to structures used in the target responses. Grammatical errors and spelling errors in participants' sentence completions were ignored during the scoring because this research only focused on the sentence structure. The prepositions "to" or "for" are both acceptable in the

process of scoring the sentences as PO.

The next step was to count the number of PO target completions, DO target completions, and other target completions following each PO prime completion for each participant in each language condition; likewise, the number of PO target completions, DO target completions, and other completions following DO prime completion were tallied. The number of DO, PO structures in the prime and target completion supposed to be different because the incomplete prime sentences and the incomplete target sentence were controlled in different way. The incomplete prime sentences were tightly manipulated to induce people to use either DO or either PO structures while the target sentences were open to DO, PO or other structures. For example, in the English DO condition, out of ten incomplete English DO prime sentences, perhaps nine of them were filled in with the DO structure and one with PO or other structure. Those nine priming sentences were believed to have potential roles in priming target production as they contained the target structure, namely DO structure. Out of the nine incomplete target sentences paired with the nine priming sentences, perhaps only six target sentences were completed with the DO structure, two with the PO structure and one with other structure. In that case, the respective numbers for this participant under English DO prime condition would be six DO targets and two PO targets and one Others targets out of nine English DO prime sentences.

Next, the DO ratios and the PO ratios in the target sentences for each participant under each condition were calculated. This was done by dividing the number of

priming sentences, which carried the expected target structures, by the number of DO targets and that of PO targets respectively. For example, for the above participant, under the English DO prime condition, the DO target ratio will be 0.67 (six DO targets out of nine DO primes) and the PO target ratio will be 0.22 (two PO targets out of nine DO primes). The Others target ratio would be left out in the analysis. To note, the scoring and calculation methods held for each participant under each condition.

Chapter 4 Results and Data Analysis

Descriptive Statistics

Descriptive statistics dealt with the raw frequencies of the target structures (DO target and PO target) that participant produced in both the priming sentences and target sentences respectively under each priming condition and the corresponding target proportion as well (see Table 4.1).

Table 4.1

The frequency and proportion of target responses produced by low and high proficiency groups under different priming conditions (with the ratio of Others target production omitted)

Priming Conditions	Low proficiency group			High proficiency group		
	Number	DO	PO	Number	DO	PO
	of	Target	Target	of	Target	Target
	Actual	Production	Production	Actual	Production	Production
	Primes	(%)	(%)	Primes	(%)	(%)
Chinese DO	298	80 (26.85%)	36 (12.08%)	300	82 (27.33%)	50 (16.67%)
Chinese PO	236	82 (34.75%)	38 (16.10%)	228	92 (40.35%)	40 (17.54%)
English DO	270	106 (39.26%)	33 (12.22%)	281	111(39.50%)	44 (15.66%)
English PO	226	84 (37.17%)	33 (14.60%)	259	58 (22.39%)	76 (29.34%)
Sum	1030	352	140	1068	343	210

Regardless of the priming condition and the L2 proficiency, all participants completed 2,400 priming fragments throughout the experiment. Out of this total, 2,098 priming fragments were filled in with the target structures, DO or PO structures. Out of 2,098 target fragments, which were paired with the above priming fragments, 1,045 target fragments were completed with DO or PO structures. These consisted of

352 DO and 140 PO targets from the low proficiency group, and 343 DO and 210 PO targets from the high-proficiency group.

Each proficiency group completed 300 priming fragments in total under each priming condition, including Chinese DO, Chinese PO, English DO, English PO priming conditions. Only when the priming fragments were completed with the target structure, as the name of the priming condition implies, can it be regarded as the actual prime. The actual prime may exert the potential priming effect. Although the incomplete priming sentences were grammatically controlled, participants were allowed to fill in the sentences any way they chose to. As such, it is likely that participants would use other structures except for DO or PO structures to complete the priming fragments. Therefore, the raw frequency of the actual primes under each condition is not necessarily still 300 and normally less than 300. For instance, the raw frequency of the actual prime for the low-English level group under the condition of Chinese DO prime was 298 while it is completely 300 for the high-English level group (see Table 4.1). Taken together, the numbers of the actual prime under each condition for each group in the current study were close to 300, the originally provided number, so it reached the desired numbers. Each prime paired with a target, and only the targets matched with the actual primes were analyzed. As for the frequency of the target production, since the incomplete target sentence was not manipulated as tightly as the primes, the way that participants completed the target sentences was much more diverse than in the prime sentence. The number of the target structures in target sentences appears to be smaller than in prime sentences. For

example, out of the 298 incomplete target sentences that matched with 298 Chinese prime sentences, 80 were completed with DO structures and 36 with PO structure (see Table 4.1). The proportions of target production are also provided which divide the raw frequency of target production by the number of the corresponding actual prime.

Regardless of the raw frequencies or proportions of each group under each priming condition, comparisons showed that the number of DO targets was overwhelmingly greater than PO targets for low and high-level groups under all four and three conditions respectively (see Table 4.1 comparing horizontally). To confirm the observed preference, paired sample t-tests were conducted. T-test involved the DO target ratio and PO target ratio under every priming condition in each group. Unlike the calculation of proportion which targeted a whole group, the ratio was calculated for each participant, as mentioned in the last section. The specific way of calculating the ratio was similar to the way of calculating the proportion in Table 4.1, namely dividing the frequency of target production by the number of the actual prime. The reason why the result of t-test does not exactly correspond to the data shown in Table 4.1 is that the ratio for an individual could sometimes be zero when participants produced zero target production (e.g., when the raw frequency of DO and PO is four and zero respectively, the ratio of DO and PO will be 1.0 and 0.0). In that case, the value of proportion does not seem to correspond to the ratio. On the contrary, when the raw frequency of DO and PO is not zero, such as four and one, the ratio for DO and PO will be 0.8 and 0.2, which does correspond to the proportion. The result of the t-test confirmed that the number of DO targets were significantly larger than PO target

under all four conditions for the low-level group (all values were $p < .05$); the high-level group showed a similar tendency under two conditions (both values were $p < .05$) except the English PO condition and the Chinese DO condition (both values were $p > .05$) (see Table 4.2 and Table 4.3). Altogether, six out of eight pairs of comparisons showed that participants produced significantly more DO structures than PO structures regardless of their level of proficiency (see Table 4.2 and Table 4.3). Hence, the statistics suggest that participants, especially those with low English proficiency, had a stronger preference for DO structures than for PO structures in ESL production regardless of the prime sentences (English conditions or Chinese conditions).

Table 4.2

Paired sample t-test of different target production under the same priming condition for the low-level group

	Paired Differences			95% Confidence		<i>t</i>	<i>df</i>	Sig. (2 tailed)
	Mean	Std. Deviation	Std. Error	Lower	Upper			
*CDO prime (EDO target) - CDO prime (EPO target)	0.146	0.328	0.060	0.023	0.269	2.436	29	0.021
CPO prime (EDO target) - CPO prime (EPO target)	0.212	0.407	0.074	0.060	0.364	2.85	29	0.008
EDO prime (EDO target) - EDO prime (EPO target)	0.265	0.336	0.061	0.139	0.390	4.315	29	0.000

EPO prime (EDO target) - EPO prime (EPO target)	0.224	0.365	0.067	0.088	0.360	3.363	29	0.002
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*Note: (CDO = Chinese DO prime condition; CPO = Chinese PO prime condition;
EDO = English DO prime condition; EPO = English PO prime condition)

Table 4.3

Paired sample t-test of different target production under the same priming condition for the high-level group

	Paired Differences				95% Confidence		<i>t</i>	<i>df</i>	Sig. (2 tailed)
	Mean	Std. Deviation	Std. Error	Interval of the Difference					
*CDO prime (EDO target) - CDO prime (EPO target)	0.107	0.314	0.057	-0.011	0.224	1.861	29	0.073	
CPO prime (EDO target) - CPO prime (EPO target)	0.222	0.350	0.064	0.091	0.353	3.471	29	0.002	
EDO prime (EDO target) - EDO prime (EPO target)	0.241	0.330	0.060	0.118	0.364	3.998	29	0.000	
EPO prime (EDO target) - EPO prime (EPO target)	-0.078	0.339	0.062	-0.205	0.049	-1.26	29	0.218	

*Note: (CDO = Chinese DO prime condition; CPO = Chinese PO prime condition;
EDO = English DO prime condition; EPO = English PO prime condition)

The above comparative analyses were conducted to verify participants' preference for DO, which they showed in the sentence production. It is worth noting that instead of comparing the volume of the different target production under the same priming condition as above, the way to judge whether there were syntactic priming effects was to compare the same target production under different priming conditions. Specifically, the indicator for the occurrence of syntactic priming effect was a greater volume of the target structure produced in the target sentence after processing the priming sentences which contained the same structure than after processing the priming sentences containing the alternative structure (Wang, 2013, p.142). In this study, for example, Chinese PO primes elicited 4.02% (16.10% minus 12.08%) more PO target structure than Chinese DO primes did in the low proficiency group and 0.87% (17.54% minus 16.67%) more in the high proficiency group. If the gap is significant, then there is a syntactic priming effect. In the same way, the results of the ratio comparisons for the rest of the conditions are as follows. English DO primes elicited 2.09% (39.26% minus 37.17%) more DO target structure than English PO primes did in the low proficiency group and 17.11% (39.50% minus 22.39%) more in the high proficiency group; English PO primes elicited 2.38% (14.60% minus 12.22%) more PO target structure than English DO primes did in the low proficiency group and 13.68% (29.34% minus 15.66%) more in the high proficiency group (see Table 4.1).

Table 4.1 shows that Chinese PO primes, English DO primes, and English PO primes elicited more English PO, English DO, English PO respectively, namely the

same kind of sentence structure as their names imply, than their counterparts (Chinese DO, English PO, English DO respectively) did in eliciting the same structures (English PO, English DO, English PO respectively). This was found irrespective of participants' English proficiency. Namely, both low and high proficiency groups showed a tendency of syntactic priming under the three priming conditions. The Chinese DO condition was the only exception, having elicited fewer DO target structures than Chinese PO primes did irrespective of participants' English proficiency. This suggests that the syntactic priming effect did not occur under this condition. Furthermore, if a difference of 10% in the target ratio of each priming condition is in favor of the syntactic priming effect, for the low-proficiency group the specific number of the participants who showed priming effects under Chinese DO, Chinese PO, English DO and English PO priming condition were 6, 8, 13, 10 respectively. The numbers for the high-proficiency group were 7, 12, 20, 20 respectively. This implies that the high-proficiency students are more sensitive to syntactic priming than the low proficiency group. However, whether all the observed differences above are statistically significant remained to be verified.

Results for Different Priming Conditions

To verify the observed differences mentioned above, a mixed repeated measure ANOVA was conducted. The data analysis focused on four types of priming conditions: 1) whether Chinese DO elicited more English DO in target response than Chinese PO did, 2) whether Chinese PO elicited more English PO than Chinese DO did; 3) whether English DO elicited more English DO in target response than English

PO did; 4) whether English PO elicited more English PO than English DO did. Thus, DO target production and PO target production were analyzed separately using a three-way ANOVA, with the ratios of the target production as the indicator of the dependent variable. There were three independent variables, with English proficiency (low and high) being the between-subject variable, priming conditions (DO or PO) and priming languages (Chinese or English) being within-subject variables.

Mixed ANOVA results for the Chinese DO and English DO priming conditions. In terms of priming effects of Chinese DO structure and English DO structure on English DO structure in the target production, the results showed no main effects. However, there were interaction between priming language and participants' English proficiency, and interaction among priming languages, priming structures, and participants' English proficiencies (see Table 4.4). Although the statistical results do not provide the specific differences of the interactions, two relevant plots reveal important information. The plot specific to the DO target production under the Chinese DO and Chinese PO priming conditions showed that Chinese DO elicited fewer DO targets than Chinese PO did for both low- and high-proficiency groups (see Figure 4.1). This finding is inconsistent with the indicator of the occurrence of syntactic priming, which was also observed earlier from the descriptive data. Thus, Chinese DO prime did not contribute to a syntactic priming effect for either the low or high English proficiency group. Contrary to the Chinese DO primes, the English DO primes elicited more DO targets than English PO primes did regardless of the proficiency group (see Figure 4.2). This seems to provide evidence for the syntactic

priming effect. However, considering that there are no main effects, it is very likely that the possible syntactic priming effect in the English DO priming condition only occurred in either the high proficiency group or low proficiency group. Thus, further analysis of the DO target production is needed.

Table 4.4

The result of mixed ANOVA (DO target as the dependent variable)

Source	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.
Priming language	.001	1	.001	.034	.854
Priming structure	.075	1	.075	1.801	.185
proficiency	.012	1	.012	.074	.786
Priming language * proficiency	.142	1	.142	6.509	.013
Priming structure * proficiency	.030	1	.030	.717	.401
Priming language *priming structure	.051	1	.051	2.323	.133
Priming language * priming structure * proficiency	.129	1	.129	5.938	.018

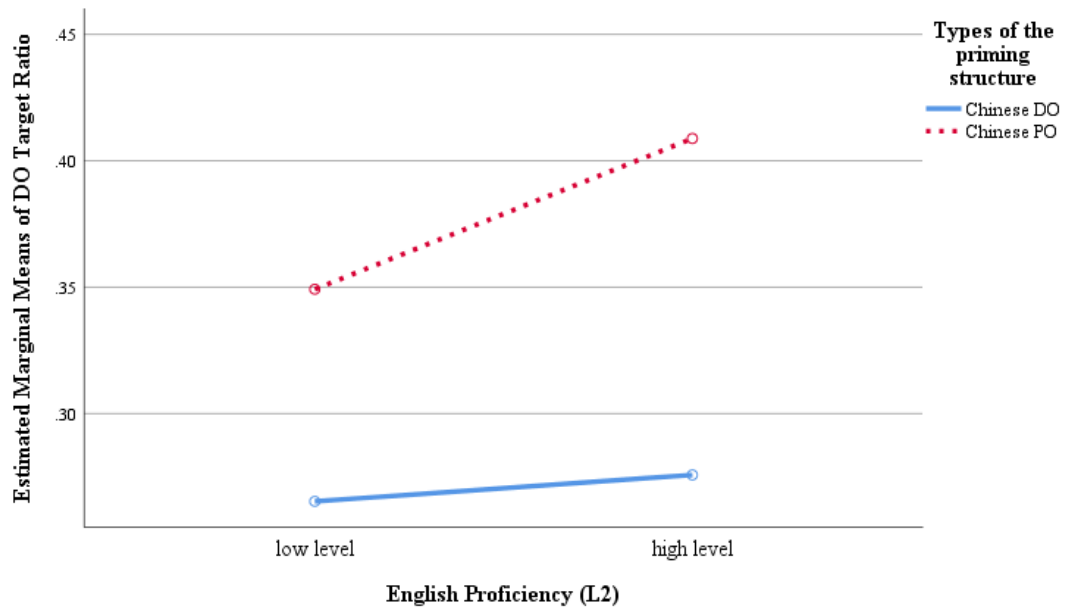


Figure 4.1. Estimated marginal means of DO target ratio under Chinese priming conditions (DO target as the dependent variable).

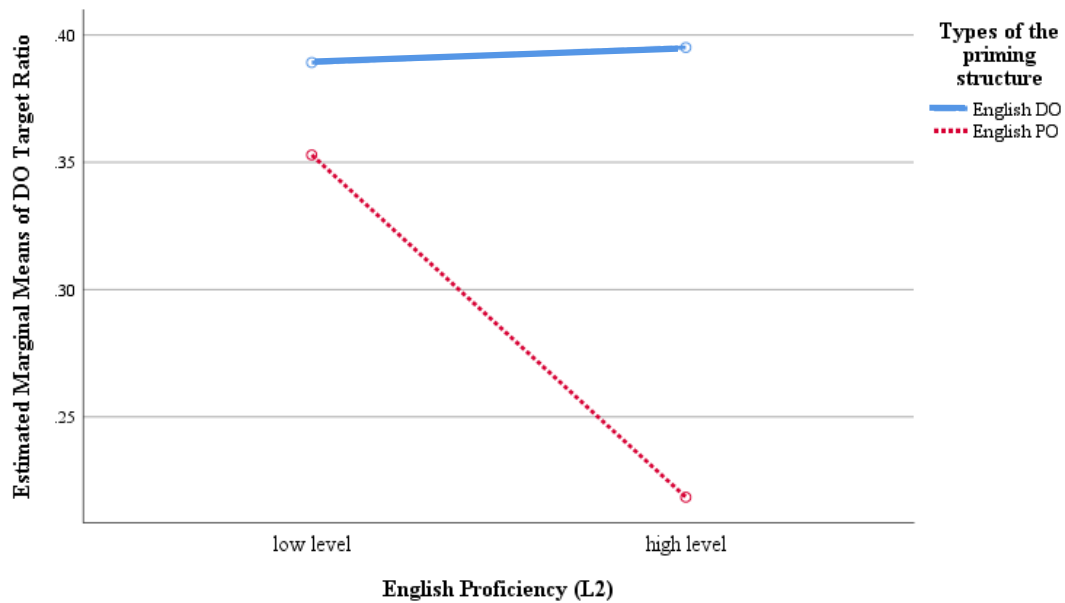


Figure 4.2. Estimated marginal means of DO target ratio under English priming conditions (DO target as the dependent variable).

Mixed ANOVA results for the Chinese PO and English PO priming

conditions. With respect to the effects of Chinese PO structures and English PO

structures on English PO structures in the target production, no main effects were found. However, there were interactions among priming language, priming structure, and participants' English proficiency (see Table 4.5). According to the plots shown in Figure 4.3 and Figure 4.4, both Chinese and English PO primes elicited more English PO targets than Chinese and English DO primes. This occurred regardless of the priming proficiency. Nevertheless, as there were no main effects but rather interactions among the three factors, the observed differences need to be verified with further analysis. Gender had been taken as a covariate throughout the mixed ANOVA analyses but no significant differences existed (all values were $p > .05$), and thus, gender had no impact on the results.

Table 4.5

The result of mixed ANOVA (PO target as the dependent variable)

Source	Sum of Squares	df	Mean Square	F	Sig.
Priming language	8.721E-5	1	8.721E-5	.007	.934
Priming structure	.029	1	.029	1.28	.263
proficiency	.164	1	.164	2.56	.115
Priming language * proficiency	.032	1	.032	2.47	.121
Priming structure * proficiency	.047	1	.047	2.09	.154
Priming language * priming structure	.001	1	.001	.07	.799
Priming language * priming structure * proficiency	.056	1	.056	4.57	.037

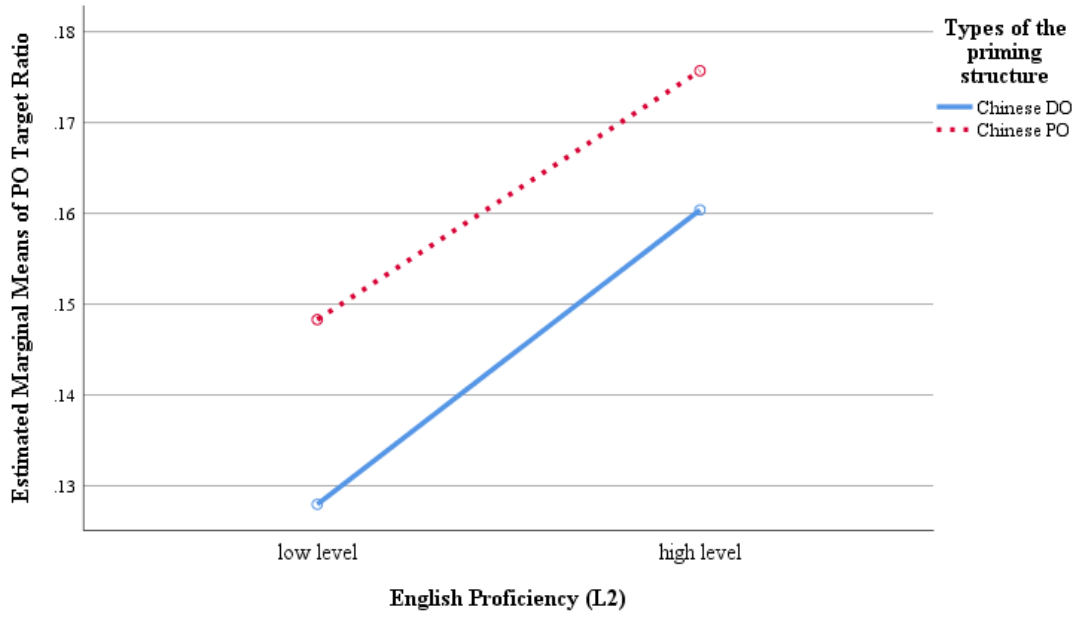


Figure 4.3. Estimated marginal means of PO target ratio under Chinese priming conditions (PO target as the dependent variable)

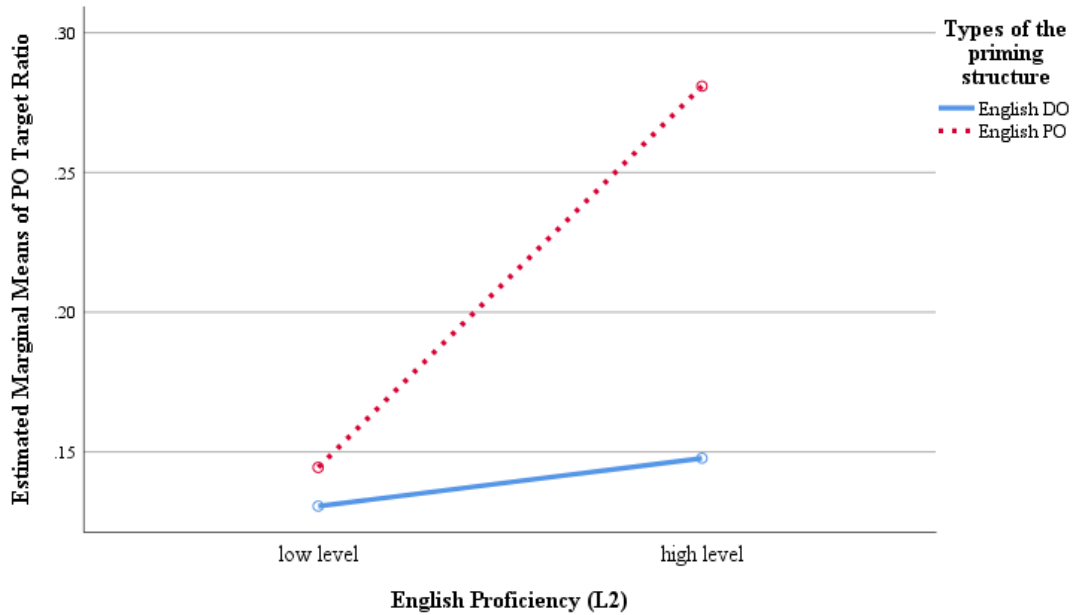


Figure 4.4. Estimated marginal means of PO target ratio under English priming conditions (PO target as the dependent variable)

One-Way ANOVA

As described above, the mixed repeated measure ANOVA analysis did not reveal main effects; however, interactions among three factors were found. The attempt to determine the differences by means of plots were not completely reliable. Therefore, a one-way ANOVA was conducted. The low and high-level groups were separated for the one-way ANOVA. The independent variable was the priming conditions (Chinese DO prime, Chinese PO prime, English DO prime, English PO prime); the dependent variables were the DO target ratio and PO target ratio. The specific descriptive statistics of the DO and PO targets of the two groups under each of the four conditions are shown in Tables 4.6 and 4.7.

The analysis conducted on the low-level group revealed no significant difference between the different priming conditions in eliciting the target structure. This occurred regardless of the DO target ($F(3, 116) = 1.180, p > .05$) or PO target ($F(3, 116) = .154, p > .05$) and regardless of the priming structures and the priming languages. Taken together, this suggests that syntactic priming effect did not occur in the low-level group under any of the four priming conditions.

The analysis conducted on the high-level group revealed significant effects of different priming conditions on both the DO target ($F(3, 116) = 4.947, p < .05$) and PO target production ($F(3, 116) = 3.710, p < .05$). Post hoc tests with Bonferroni correction specific to the high-level group showed a significant difference between the English DO and English PO priming conditions no matter in eliciting DO target and PO target. No significant differences were found for the Chinese DO and Chinese

PO priming conditions. Specifically, for the high proficiency group, the English DO prime induced significantly more DO target productions than English PO primes ($Md = .185, p < .05$). Similarly, the English PO primes induced significantly more PO target productions than the English DO primes ($Md = .134, p < .05$). Thus, the high proficiency group showed a priming effect within English regardless of the structure. However, no priming effects across the two languages were found. Additionally, the mean differences above indicated that the English DO structures brought about stronger priming effects than the English PO structures.

Table 4.6

Descriptive statistics of DO and PO target ratios of the low proficiency group under four conditions

	*CDO		CPO		EDO		EPO	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
DO Target	.268	0.258	.358	.280	.391	.265	.363	.273
PO Target	.122	.111	.146	.195	.126	.153	.139	.168

Table 4.7

Descriptive statistics of DO and PO target ratios of the high proficiency group under four conditions

	*CDO		CPO		EDO		EPO	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
DO Target	.273	.230	.400	.245	.394	.237	.209	.208
PO Target	.167	.160	.177	.171	.153	.183	.287	.183

*Note: CDO = Chinese DO prime condition; CPO = Chinese PO prime condition;

EDO = English DO prime condition; EPO = English PO prime condition

Summary

Paired-samples t-tests revealed that Chinese English learners, especially low-level students, had a preference for DO structures in the target production under all conditions. High-level students showed the same preferences under Chinese PO and English DO priming conditions. Then, both low-and high-level groups have shown the tendency which is similar to the syntactic priming under the Chinese PO, English DO and English PO condition. Contrary to what was expected, the Chinese DO primes elicited significantly fewer DO structures than the Chinese PO did for both groups. Despite the positive tendency under the three conditions and the interactions among the three factors, one-way ANOVA and post hoc analysis indicated that syntactic priming effects were not robust. Specifically, the English-English within-language syntactic priming effect occurred in the high-English level group regardless of the prime, whereas there were no significant effects across the languages. Additionally, both the English-English and Chinese-English syntactic priming effect did not occur in the low-English level group. Although the two groups with the different proficiencies did not shown significant priming effects under Chinese PO primes, both groups did show a tendency of occurrence; the same held for the low-level group under English DO and English PO primes.

The current study's research questions focus on the influence of priming structure, English as second language proficiency, and priming languages on the syntactic priming effect. The results indicate that the English PO and English DO structures induced the syntactic priming effect for Chinese English learners. This was

not found for the Chinese DO and Chinese PO structures. Additionally, Chinese English learners with high proficiency showed syntactic priming effects within languages but not across languages. Low proficiency group did not show effects for within or between languages. The strength of within-language syntactic priming was found to be larger than between-languages one now that there were no significant between-language priming effects for the Chinese high school students.

Chapter 5 Discussion

Few studies involving the syntactic priming effect have been conducted at the high school level and few have compared Chinese-English and English-English priming at the same time. This study compares cross-linguistic priming (Chinese-English) and within-language priming (English-English) under both DO and PO structures of two groups of senior two Chinese students with different English proficiencies. Based on the results and guided by the research questions and hypotheses, this section will discuss how sentence structures, Chinese English learners' English proficiency, and priming languages influence syntactic priming effects. The discussion ends with the syntactic representation of Chinese English learner of senior two and the most recent developmental model for second language acquisition.

Priming Structures and Syntactic Priming

The first question of the current study is whether English and Chinese PO and DO structures can produce the syntactic priming effect for Chinese English learners. Results show that both DO and PO produced syntactic priming effect albeit only under the English prime condition and only in the high proficiency group. Similar to the research by Pickering and Bragnigan (1998), who were the first to use the sentence completion task to examine the syntactic priming effects in both DO and PO structures within English, the current study found that DO and PO structures can elicit a syntactic priming effect within English. Specifically, producing English DO in priming sentences elicited 17.11% more DO structures than PO prime; namely, the

magnitude of the English DO structure was 17.11%; and completing the priming sentence with English PO elicited 13.68% more PO structures than completing the sentence with DO prime. Thus, the magnitude of the English PO was 13.68%. The effects found in the current study are higher than the effects found in Pickering and Bragnigan's experiment. They found a 9.8% effect in DO structure and a 11.7% effect in PO. Pickering and Bragnigan (1998) examined effects across different languages, so it is not comparable with the current study in terms of between-language syntactic priming. As mentioned, the effect of English DO found in this study was 17.11% and English PO was 13.68%. Thus, the effect of DO was larger than that of PO. The Chinese English learners' preference for DO structures may explain this finding. The comparison between the DO and PO target production via a paired sample t-test for each single priming condition showed that the two groups of participants produced significantly more DO targets than PO ones under four and two priming conditions, respectively. This suggests that Chinese English learners had a preference for DO structures in English production. As Lei (2010) argued, the preference for certain structures may become an inhibitor for the occurrence of the priming effect induced by the alternative structure. Participants' preference for DO may be associated with Chinese people's language habits. According to Guo (2007) who conducted a statistical analysis on the modern Chinese corpus from Center for Chinese Linguistics PKU, Chinese people use DO much more frequently than PO in their first language. At the high school level, Chinese English learners' Chinese and English proficiencies are unbalanced with the first language dominant over their second language. As such,

it is very likely that students' habits in using L1 will influence L2 performance. Zhang (2016) conducted one of the few syntactic priming studies involving the high school level. Zhang compared three groups of participants with three different proficiencies by including high school students, college freshmen and junior students. Zhang (2016) only examined between-language syntactic priming on Chinese and English passives via the picture description task. Similarly, he has not found between-language priming effect in high school students (the low level in that study). The explanation provided by Zhang was that the nonoccurrence might be associated with the L1 dominance over L2 which might cause participants to borrow L1 syntactic knowledge to carry out L2 performance. Contrary to the current study, Pickering and Bragnigan (1998) found a stronger effect of PO than DO. This gap of magnitude in syntactic priming effects can also be understood with the language habits of English-native speakers. English-native speakers use PO more frequently than DO, which may explain why participants showed stronger priming effects in PO than in DO.

Few studies have examined DO and PO structures via the written sentence completion task. Apart from Pickering and Bragnigan (1998), to my knowledge, the research by Zheng (2013) is the only other study which employed the written sentence completion task to examine the syntactic effect in DO and PO structures within English. One difference of Zheng's research from Pickering and Bragnigan is the research focus, where Zheng examined between language syntactic priming from Chinese to English in bilinguals. Zheng's finding was inconsistent with Pickering and Bragnigan (1998)'s finding as well as the current study's because within-language

syntactic priming effects did not occur both in low and high proficiency groups in her research. However, Zheng (2013) did find between-language syntactic priming in both low and high proficiency groups. Thus, the findings of the current study contradict Zheng (2013) as the current research did not find between-language syntactic priming. These differences may be attributed to the participants' English level. Zheng (2013) targeted undergraduate students and postgraduates from China, whereas the current study targeted Chinese senior two students. A tentative assumption is that the university students in Zheng's research had formed shared representation across languages. This could have facilitated the occurrence of the between-language priming while the high school students may have not yet reached the shared representation.

Although the low-proficiency group in the current study did not show syntactic priming effects in English DO and PO structures, their target production did have a tendency towards the occurrence of syntactic priming, with the effects of English DO being 2.09% (39.26% minors 37.17%) and English PO structure being 2.38% (14.60 minors 12.22%, see Table 4.1). The strengths, however, are not statistically significant. The target production by the low-level and high-level groups under the Chinese PO priming condition also showed such tendencies close to a syntactic priming effect, although not significant, with the strength being 4.02% and 0.87%, respectively. However, Chinese DO was the only priming structure which did not exert any positive influence in priming the production in both low and high proficiency groups because its alternative structure, Chinese PO, even primed more

production of English DO than Chinese DO did, which is the opposite to the indicator of the occurrence of syntactic priming. The instability of the syntactic priming effect may explain the exceptional circumstance. Wang (2009) noted that the occurrence of syntactic priming might not be a stable mental process.

Most of the previous research has focused on syntactic priming effects at the university-level and found robust syntactic priming effects (Kaschak et al., 2011; Bernolet et al., 2013; Song & Do, 2018). The current study extends previous findings by providing evidence that syntactic priming can also occur at the high school level. The current study found significant English DO and PO priming effects in high proficiency Chinese English learners; the study also found a number of positive, albeit not significant, tendencies under most of the conditions, including the English DO and PO conditions for low proficiency groups, and the Chinese PO conditions for both low and high proficiency groups. The occurrence of syntactic priming effects in English DO and PO suggests that exposure to a certain type of structure may encourage participants to use the structure more frequently than the alternative one in subsequent production. The reason why the tendency did not reach a significant level may be due to the constraints of English proficiency or language distance, which is closely associated with the syntactic representation. What is most definite is that the occurrence of syntactic priming is not strongly related to the priming structure, as both DO and PO showed syntactic priming effects with the same group of participants. The following sections continue the discussion from the perspective of L2 proficiency and the types of priming language.

Second Language Proficiency and Syntactic Priming

The current study compares syntactic priming effects in low and high proficiency groups by targeting Chinese English learners at senior two, who have a similar background and academic experience but differed in English proficiency. The results showed that the low-proficiency group did not demonstrate the syntactic priming effect and the high-proficiency group only demonstrated syntactic priming within language. Although the remaining conditions did not reach a significant level for both the low- and high- level participants, the results indicated positive tendencies, which were close to syntactic priming under most conditions except under Chinese PO.

The results are partly consistent with the hypotheses in that there is indeed an interaction between English language proficiency and priming language. However, the magnitudes in the current study are much weaker than the previous assumption according to which low proficiency group would show greater priming within languages than across languages, and the high level one would show greater priming across languages than within languages. Nevertheless, the current study found that strengths of within- and between- language syntactic priming are not equal and differ in participants of different L2 levels. Most importantly, the result aligns with the logic of the hypothesis that the high proficiency group will show greater syntactic priming effects than the low proficiency group. The current study found the syntactic priming effect in the high proficiency group but not in the low proficiency group.

Compared with most previous research which found robust within- and between-

language priming in bilinguals (e.g., Schoonbaert et al., 2007; Bernolet et al., 2013; Kantola and van Gompel, 2011), the syntactic priming effects in the current study were limited, with no between-language priming effects showing and the within-language priming effect only occurring for the high proficiency group. Despite the different results, the current research is consistent with most previous research in terms of the findings that the magnitude of syntactic priming effect in participants with high proficiency is greater than those with low proficiency (Wang, 2009; Zhao, 2014; Yan, 2011; Hartsuiker et al, 2014; Shin & Christianson, 2009). For example, Wang (2009), whose research focused on the influence of L2 proficiency on English-English syntactic priming effects, found that junior English major students were significantly more sensitive to syntactic priming effects than fresh English major students. On the other hand, the current research is inconsistent with the previous research which found that the low-level L2 learners had greater advantage in syntactic priming than high-level learners. For example, Li (2006) and Zheng (2013) found the syntactic priming effect in the low-level group but not in the high-level group. Thus, although a number of studies have recognized proficiency as an important factor in syntactic priming, a consensus in how proficiency influences syntactic priming has not yet been established.

According to the activation accounts by Pickering and Branigans (1998) and Hartsuiker et. al (2004), the occurrence of syntactic priming can be explained as follows. Processing a sentence structure can activate the corresponding combinatorial node which is connected to a verb. Accordingly, if a series of dative verbs have shared

combinatorial nodes, the activation of a verb and its combinatorial node also means the activation of the combinatorial nodes of the other verbs. Thus, students will use the same structures to complete the sentences which are led by different dative verbs. Hartsuiker and Bernolet (2017) believed the prerequisite for the occurrence of syntactic priming is that people have formed the abstract syntactic representation for the same kind of sentence structures so that the activation will be possible. The manner of syntactic representation of the English learners relates to bilinguals' L2 proficiency (Hartsuiker & Bernolet, 2017). Specifically, Hartsuiker and Bernolet (2017) held that the syntactic representation of a second language learner is in a dynamic system, developing as English proficiency increases and developing from an independent representation to a shared representation. Accordingly, the higher the L2 proficiency, the higher degree of the abstract representation or shared representation, and in light with the activation account, there will be stronger syntactic priming effects. The developmental view is consistent with the theory of usage-based language acquisition, a second language-acquisition theory by Ellis and Freeman (2006). Ellis and Freeman (2006) posited that language acquisition is highly associated with the frequency of use whereby people gradually abstract and acquire the patterns in the second language with the increasing use of L2.

According to the above developmental view about representation and theory of usage-based language acquisition, the different sensitivity to syntactic priming in this study makes sense. The high proficiency group has developed an abstract representation within L2 (English) while the low proficiency group has not yet

developed this representation. This may explain why the high proficiency group showed syntactic priming effects within L2 (English) while the low proficiency group did not, and why participants showed positive tendencies towards syntactic priming but not significant. It is possible that participants did not form abstract representations due to the constraint of their limited L2 proficiency. In the same vein, the reason why both groups did not show syntactic priming across languages may be attributed to the absence of the shared representation between L1 (Chinese) and L2 (English), at least at the time of the experiment.

Compared with previous research in China and abroad examining the effect of L2 proficiency, most of which found robust within- and between-language priming as mentioned earlier, the syntactic priming in the current study is limited. For example, Kantola and van Gompel (2011) found equally strong syntactic priming effects within the language and between languages in university students whose English (L2) was highly proficient. The experimental paradigm used by Kantola and van Gompel (2011) was the sentence completion task. One obvious difference between the current study and Kantola and van Gompel (2011) is that the current study targeted Chinese EFL learners at the high school level while the latter study targeted Swedish-English bilinguals whose English was highly proficient. Bernolet (2008)' study also showed more robust priming effects than the current study. Bernolet (2008) incorporated low and high-proficiency students to compare within and between language syntactic priming. The results indicated that both groups showed within priming whereas the low proficiency group did not show between-language priming. Thus, Bernolet (2008)

concluded that L2 proficiency is responsible for the nonoccurrence of syntactic priming and low proficiency students have not yet formed a shared representation between L1 and L2. Likewise, most of the existing research targeting undergraduate students or postgraduate students with relatively high English level or well-balanced bilinguals ascribed the occurrence of syntactic priming to the bilingual shared representation of participants. Based on the above discussion, the limited syntactic priming effects of the current study suggest that Chinese English learners' L1 and L2 are probably still separately represented. Also, the different strength of the priming effects between this study and previous studies could be explained by the theory of usage-based language acquisition by Ellis and Larsen Freeman (2006) mentioned earlier. Compared with the high school students in this study, participants at the university level, in general, had richer L2 experiences so their syntactic representations were closer to a native speaker's representation. This contributes to a stronger syntactic priming effect.

Based on the current study's findings, it can be suggested that the occurrence of syntactic priming demands proficiency of the target language and that higher proficiency means a higher degree of abstract representation. Accordingly, the findings are consistent with the developmental view of the bilingual shared representation.

Comparison of within-Language Syntactic Priming and between-Languages Syntactic Priming

This study compares within-language priming and between-languages priming.

Findings show that there were priming effects in English to English priming but only in the high proficiency group. Priming effects did not occur in Chinese to English priming regardless of the proficiency group. This finding is consistent with the hypothesis as the within-language syntactic priming was stronger than the between-language syntactic priming. Also, this finding is consistent with the hypothesis that if participants do not show within-language syntactic priming, they will not show priming across languages.

The divergence of within and between-language syntactic priming in the current study suggests that language distance influences participants' syntactic priming. Chinese is of Sino-Tibetan language and English is of Indo-European, so they are distant with each other in terms of syntax, with the former being the logographic writing system and latter being the alphabetic system. This suggests that to form a shared representation between Chinese and English should require more language experience from the Chinese English learners. This is according to the theory of usage-based language acquisition (Ellis & Larsen Freeman, 2006). Previous researchers focused on syntactic priming between Indo-European languages, such as Dutch to English (Desmet & Declercq, 2006), English-Spanish (Hartsuiker, 2004), and English-German (Loebell & Bock, 2013). The syntactic priming effects they found are more robust than the current research. This may be attributed to language systems of these studies. It may be easier for participants to establish shared representation in these studies as the languages they tested shared the same language system. In contrast, it is likely that the distance between Chinese and English together

with the limited experience with L2 were the main reasons why the high school students in this study have not yet formed the shared representation, and thus syntactic priming between languages did not occur.

Syntactic priming predicts shared representation (Hartsuiker & Bernolet, 2017). The occurrence of within-language syntactic priming in the high proficiency in this study indicated that high-proficiency participants have formed an abstract representation within languages. The findings that the low-level group showed neither priming within nor across languages imply that they have not formed the abstract-representation within languages or the shared representation across languages. This finding is supportive of Bernolet et al.'s developmental view, that the representation evolves from a language-specific representation to a shared-representation (2013).

It is noteworthy that Bernolet et al.'s developmental view was put forward based on the findings from the late bilinguals and that this developmental view only involved two-stages (2013). Thus, taking L2 beginners into account, Hartsuiker and Bernolet (2017) suggested a new developmental model. According to this developmental view, as bilinguals' L2 proficiency increases, the representation of L1 and L2 will become fully integrated, and it should go through at least three continuous stages: item-specific representation within language, the abstract representation within language, and the shared representation across languages.

The current study's findings appear to support the developmental model of syntactic representation. The low proficiency group in the current study produced neither within-language syntactic priming nor between-languages. This suggests that

participants' syntactic representation is at the item-specific stage within the second language and separate across languages, which match stage three or a lower stage if put into the developmental model (see Figure 2.3). The high proficiency participants showed a syntactic priming effect within the second language but not across languages. This suggests that their representation within L2 is abstract and does not rely on specific items. However, the representation across L1 and L2 are still not entirely integrated, which matches stage four in the developmental model. Stage five of the developmental view is the shared representation of two languages. Participants in this study regardless of proficiency have not yet reached this stage as they did not show any between-languages syntactic priming effects. This finding suggests that the syntactic representation of the high-proficiency participants was at a higher stage than the low proficiency participants. Thus, the results of this study are in line with the developmental model. That is, the syntactic representation develops as proficiency increases. Thus, it is likely that syntactic priming across languages will occur with the participants in the current study when their L2 proficiency increases. In reviewing the previous research targeting university-level bilinguals (Chinese-English), many studies found syntactic priming effects across language (e.g., Chen et al., 2013; Gu, 2016; Zhao, 2014; Zhang, 2016). Zhang (2016) conducted between-language syntactic priming effects in high school and university-level students. Different from the current study, she tested the passive structures via the picture description task and did not involve the within-language syntactic priming. Zhang (2016) found that the high school students did not show between-language syntactic priming but the high-

proficiency group did. Zhang (2016) ascribed the non-occurrence of effects in the low-proficiency group to the separate representation between L1 and L2; and concluded that the representation would be shared as the language proficiency increased and the syntactic priming effects would increase at the same time.

Overall, the current study found asymmetric effects, with within-language syntactic priming occurring in the high proficiency group; however, no between-language were found regardless of proficiency. The nonoccurrence of priming across languages can be attributed to the separate representation between Chinese and English. Few studies have compared English-English within language syntactic priming and Chinese-English syntactic priming. The findings of the current study support the developmental model.

Chapter 6 Conclusions

Overview of Major Findings

The current study has compared English within-language and Chinese between-languages syntactic priming by employing a sentence completion paradigm and conducting a mixed-design experiment. Specifically, this study investigated the impact of three factors on syntactic priming, including language structures, ESL proficiency, and priming language. Although the results do not completely conform with the hypotheses, the results are consistent with the underlying logic behind the hypotheses. The following are the major findings.

Firstly, both DO and PO can elicit a syntactic priming effect. However, syntactic priming occurred only under the English priming condition and not under the Chinese priming condition in this study. Additionally, syntactic priming only occurred in the high proficiency group. Although the effects under the remaining conditions were not significant, most of them displayed a tendency toward priming. The findings above provide some evidence that processing a structure can activate implicit learning. This study also found a stronger priming effect of DO structures than PO structures in the English-English priming. This may be attributed to the participants' L1 dominance and their preference for using DO in Chinese.

Secondly, the different results between the participants with different L2 levels indicate that syntactic priming demands second language proficiency. This was demonstrated through an internal and external comparison. On one hand, the high proficiency group produced syntactic priming effects but the low proficiency group

did not show any effects. The non-occurrence of syntactic priming in the low proficiency group and the non-significant tendency can be ascribed to the limited L2 proficiency. On the other hand, the magnitude of syntactic priming effect in this study is lower than that in previous research which mainly targeted university students or proficient bilinguals. According to the usage-based language perspective, participants in this study who were at the high school level did not have as much experience with English as the university students. This may have limited the development of shared representation and thus, they showed weaker syntactic priming.

Lastly, the strengths of English-English and Chinese-English syntactic priming are unequal for Chinese high school English learners. The unequal strengths have confirmed the developmental view of syntactic representation by Hartsuiker and Bernolet (2017). Only priming within languages occurred and there were no priming effects across languages, regardless of proficiency. Thus, English to English priming appeared to be stronger than Chinese to English priming. The unequal effects between within- and between-language priming can be attributed to the distance between Chinese and English in terms of syntax, which may have increased the difficulty for the high school students to integrate the two languages' syntax and develop a shared representation across the languages. These results indicate that low-proficiency high school students are at the item-specific representation and the high proficiency students have formed language-specific representation. Both groups have not yet formed a shared representation across Chinese and English. It is concluded that the representation of high proficiency is abstract. This finding suggests that representation

will evolve with the L2 proficiency improving. The different representation manner of the low and high proficiency group also suggests that representation should not be simply accounted with separate or shared representation. The findings align with the developmental models and thus, to some degree, support the development views (Hartsuiker et al., 2004; Bernolet et al., 2013). According to the developmental model, which consists of five stages for bilingual representation, the high-level group in this study should be at the stage of within-language (L2) abstract representation, whereas the low-level group should be at the item-specific stage. Additionally, it can be expected that there will be occurrence of cross-linguistic syntactic priming by the time participants' L2 proficiencies are high enough to form shared representation across Chinese and English.

Theoretical and Pedagogical Implications

Theoretical implications. With respect to the mental representation of syntactic information, instead of simply either the independent-representation account or the shared-representation account, the findings of the current study coincide with the developmental model, as discussed earlier.

Syntactic priming may be able to help second language learners develop L1 thinking patterns by motivating them to capture the abstract representation of syntax. It is likely that the second language learners' language habits in their mother tongue are reverse to L2 language habits from native speakers, such as Chinese prefer using DO while English native speakers prefer using PO. This situation may stop the second language learners from producing L2 like a native speaker. However, syntactic

priming may be able to modify this situation. As the results showed, Chinese high school students in the current study produced more PO when primed by the English PO structures even though they have a preference for DO in L1 production.

Also, the occurrence of the English within-language syntactic priming effects in Chinese high school students offers a theoretical foundation for the Continuation Task from the perspective of psycholinguistics. The continuation task has been a focus of research, especially in recent years in China. It is also one of the types of English composition in college entrance examinations of the Zhejiang province in China. The continuation task is a type of language production task wherein participants are required to read the designated text whose ending has been removed and then complete it through writing, which has been taken as a way to facilitate ESL learning (Wang, 2012). It is believed that what makes the continuation task work is the occurrence of alignment between the reading materials and written production in terms of language form and content. Wang and Wang (2014) stated that the mechanism for alignment in terms of language form is syntactic priming. Accordingly, the occurrence of syntactic priming effect in this study within English has provided evidence for the existence of the alignment of language forms when students perform the continuation task. Additionally, Wang and Wang (2014) found that performing a continuation task after Chinese reading materials showed fewer positive effects in English production than following English reading material in terms of facilitating English written production. Wang and Wang (2014) accounted for their findings with syntactic priming. The fact that this study found only English-

English syntactic priming but no Chinese-English priming confirmed their explanations.

Pedagogical implications. Since this study was conducted under experimental conditions, pedagogical implications are addressed in a conservative way. Syntactic priming has been partly found in the current study. Wang and Wei (2018) suggests that syntactic priming is implicit learning in nature and can facilitate the learning of second language syntactic structures. There are two aspects of pedagogical implications based on the current study.

The first pedagogical implication relates to the Continuation Task. In order to ensure the promotion effect of the continuation task, the reading material should include the target structures as much as possible which students should master at a certain stage of second language learning. However, the design of the continuation task may need to be adjusted according to the participants' second language level. For low proficiency students who have less advantage in implicit learning, as is shown in this study, it is suggested that the target structure appearing in the reading materials be underlined or highlighted. This will arouse students' awareness to the target structures and encourage them to imitate the structures consciously. As Xin (2017) suggested the continuation tasks should match the developmental stage of students' second language.

Additionally, the findings have suggested the possibility of implicit learning through the incorporation of the syntactic priming phenomenon. The occurrence of syntactic priming suggests that implicit learning can exist. Teachers can try to

incorporate syntactic priming to facilitate students' acquisition of target sentence structures or to enhance students' syntactic knowledge. Teachers can create opportunities for implicit learning based on the idea of priming. For example, a teacher might expose students to a large number of target structures through discussions and teaching materials, or incorporate an interactive task to prime students' production of a certain type of target structure (Shin & Christianson, 2012). Moreover, the status of the separate representation of the high school student suggests that it may be more effective for teachers to use English to teach English than to use Chinese, which can strengthen students' representation and trigger syntactic priming within L2 to some degree. During explicit teaching, teachers might consider adopting such strategies to increase the possibility of triggering syntactic priming and implicit learning. This could facilitate students' syntactic acquisition.

Limitations and Suggestions for Future Research

Despite the experimenter's efforts to make the experiment design perfect, there are five limitations of this study. First, for the high school students, the sentence completion task took participants quite a bit of time to finish. This may have increased their cognitive load, especially towards the end of the task. Second, to make the experiment design perfect, the initial plan was to find two groups of participants who differed in English but were consistent in Chinese and Math. Due to the limitation of the experimental conditions, the two groups of participants were different in Chinese and Math, with mean differences being approximately seven and eight scores respectively. Nevertheless, the two groups did show differences in

English, with the mean difference up to almost 20 scores ($Md = 19.22, p < .001$).

Third, the tested structures, DO and PO, were commonly used in most of the previous research targeting the university-level population. DO and PO structures were used in the current study to compare with the previous studies; also, for the sake of the high school students' English proficiencies which are much lower than university-level students, DO and PO would be more suitable for them than the complicated structures or those rarely tested by previous research. Four, several filler sentences containing verbs *wrote*, *play*, *find* or *cook* could be completed as sentences with DO or PO structures. Thus, those filler sentences could act as priming sentences and increase the priming effects for both groups. However, the verbs above are not as commonly used as dative verbs, as the verbs in the actual prime. Finally, the data were collected from a high school which produces relatively high scores. The findings may not necessarily apply to other general Chinese high school students.

Based on the findings, there are some suggestions for future research. First, to build on the current findings, rather than merely focusing on high school students, researchers can further compare syntactic priming in high school students with university students or well-balanced bilinguals. This can help investigate whether the representation is always separate for Chinese English learners during the period of high school and verify whether it develops as L2 proficiency increases. Second, future research targeting high school can take verb repetition into account. Previous research has found that verb repetition between priming and target fragments would increase the magnitude of priming effects. As priming effect found in this study was partly

constrained by participants' limited English level, their priming effects may become stronger if verb repetition was adopted. Third, the existing syntactic priming research in China shows a lack of comparison of English-English syntactic priming and Chinese-English syntactic priming, and thus a call for further research on such comparisons. It will be rewarding if the comparison of the population with different L2 proficiencies is involved. Additionally, more attention can be shifted to the high school level or middle school level, as well as to different paradigms or techniques to investigate the generalizability of the existing accounts about bilingual representation. Also, this study noticed that different verbs have different sensitivities to syntactic priming. As this study used a within-subjects design, the verb-variation will not influence the examination of three factors. The verb-variation is not the focus of this study. However, it is recommended that more research on between-verb variation be conducted. Lastly, apart from investigating the bilingual representation via priming effect, it is worth exploring how to facilitate students syntactic learning by utilizing the syntactic priming phenomenon; some researchers abroad have begun to conduct classroom-based research to explore the value of syntactic priming in second language acquisition.

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Appendix I Sample of Experiment Items

Experiment items (prime-target pairs) of four conditions will be randomly assigned to the booklet through Latin Square design. *P* indicates prime fragment; *T* indicates Target fragment. In the Chinese condition, the corresponding English translation is provided in brackets following each sentence. All tags and translations will not be present in the booklet and there will be no highlighted text in the formal experiments.

(1/4) English DO prime condition

1. P: The mother gave the child...
T: The actor sent...
2. P: The young man showed his father...
T: The little girl handed...
3. P: The farmer offered his neighbor...
T: Her mother passed...
4. P: The policeman lent the woman...
T: The worker gave...
5. P: The author sent the company...
T: The patient showed...
6. P: His teammate passed him...
T: The farmer sold...
7. P: Their cousin lent them...
T: The designer sent...
8. P: The reporter handed the musician...
T: His uncle gave...
9. P: The son showed his parent...
T: The teacher lent...

10. P: The president gave his daughter...

T: The business man offered...

(2/4) English PO prime condition

1. P: His grandmother lent his umbrella...

T: The salesman sold...

2. P: The waiter passed a chair...

T: His boss offered...

3. P: The stranger gave a boat ticket...

T: The teenager showed...

4. P: The waiter offered services...

T: The French singer lent...

5. P: The businessman sold a computer...

T: The writer sent...

6. P: Her aunt lent a plate...

T: The customer gave...

7. P: The hunter handed the rabbit...

T: The football player passed...

8. P: Grandfather showed the map...

T: His classmate gave...

9. P: The student sent an e-mail...

T: The police offered...

10. P: The lawyer showed a photo...

T: The teenager handed...

(3/4) Chinese DO prime condition

1. P: 快递员递给学生... (The postman gave the student)

T: The handsome boy showed...

2. P: 她的朋友寄给她... (Her friend sent her)

T: The brave captain gave...

3. P: 药店老板递给他... (The drugstore owner passed him)
T: The smart farmer sold...
4. P: 退伍老人展示给他孙子... (The retired soldier showed his grandson)
T: The great father handed...
5. P: 经理送给顾客... (The agent gave the customer)
T: The volunteer offered...
6. P: 她借给室友... (She lent her roommate)
T: A stranger passed...
7. P: 父亲寄给他... (His father sent him)
T: The driver showed
8. P: 主持人传给她... (The host handed her)
T: The photographer sent...
9. P: 店员卖给他... (The clerk sold him)
T: The brave man offered...
10. P: 辅导员提供给新生... (The assistant offered the freshman)
T: He lent...

(4/4) Chinese PO prime condition

1. P: 服务员递了份菜单... (The servant gave a menu)
T: His brother lent...
2. P: 秘书发了一份文件... (The secretary sent a document)
T: The doorman offered...
3. P: 设计师展示了她的最新作品... (The designer showed her newest work)
T: The painter showed...
4. P: 房东借了一张被子... (The landlord lent a quilt)
T: The engineer gave...
5. P: 船长递了一个救生圈.... (The captain handed the lifesaver)
T: The old man gave...
6. P: 求职者投了他的简历.... (The job hunter sent his resume)
T: The basketball player passed...

7. P: 粉丝展示了她的礼物... (The fan showed her gift)
T: The wife handed...
8. P: 毕业生送了他的单车... (The graduate gave his bike)
T: The doctor sent...
9. P: 代理商提供了一个样本... (The agent offered a sample)
T: The children showed...
10. P: 班长传了一份报纸... (The monitor passed a newspaper)
T: The American writer sold...

Filler fragments

Types	English
A. noun phrases modified by adjectives	1. The yellow flower...
	2. His 3-year-old sister...
	3. The broken car...
	4. The orange tree...
	5. The new cowboy...
	6. The Italian dancer...
	7. His blue shirt...
	8. The new year...
	9. The nice woman
	10. Her big eyes...
B. noun phrases by a preposition phrase	11. The book in the bag...
	12. The phone on the chair...
	13. The teacher in the office...
	14. The chicken under the desk...
	15. The bird on my shoulder...
	16. The sand in his shoes...
	17. The children in the playground...
	18. The computer on the table...

	19. The house in the forest...
	20. The apple on the tree...
C. noun phrases	21. The dog was drinking...
followed by a verb or	22. This boy stands...
a verb phrase	23. The lady liked...
	24. The little baby is eating...
	25. The guard closes...
	26. The popular singer plays...
	27. The little birds fly...
	28. The kid was reading...
	29. Her family supports...
	30. The man didn't remember...
	31. They are watching...
	32. The student can understand ...
	33. His smile is...
	34. Different people have...
	35. Her favorite color is...
	36. The girl wrote...
	37. The boy played...
	38. The hungry man was enjoying...
	39. Her roommate can speak...
	40. She decided to...
	41. The cat is looking for...
	42. The house is made of...
	43. His grandpa went to...
	44. The girl wears...
	45. The woman opened ...
	46. His sister found ...
	47. She lost...

	48. The student finished ...
	49. The swimmer won...
	50. The sky is...
D. noun phrases	51. My mother cooked a good ...
followed by a verb	52. She has beautiful...
and a noun phrase or	53. The lady tried her best ...
an adjective phrase	54. He gets a great...
	55. He wastes a lot of...
	56. The writer finished his...
	57. He has a red...
	58. The man drunk a cup of...
	59. The farmer is waiting for his...
	60. He watched a good...
Types	Chinese
A. noun phrases	61. 他爽朗的笑声... (His hearty laughter)
modified by	62. 老师的鼓励... (Teacher's encouragement)
adjectives	63. 敬业的员工... (Engaged employees)
	64. 街上的人们... (People on the street)
B. noun phrases by a	65. 百灵鸟在树上... (The lark...on the tree)
preposition phrase	66. 学生在课上... (The student...in the class)
	67. 校长在开学典礼上... (The principal...on the opening ceremony)
	68. 乘客在车站... (The passengers... at the bus stop)
C. noun phrases	69. 过度的节食会... (Extreme dieting will)
followed by a verb or	70. 阳光洒在... (The sunshine spilled on)
a verb phrase	71. 队伍开始... (The troop began to)
	72. 阅读可以... (Reading can)
	73. 猫爬到了... (The cat climbed up)
	74. 他善于... (He is good at)

	75. 所有学生完成了... (All students finished)
	76. 花引来了... (The flower has attracted)
	77. 他在看... (He is watching)
<hr/>	
D. noun phrases	78. 好天气带给人... (Good weather brings people)
followed by a verb	79. 平和的心态让她... (A peaceful state of mind made
and a noun phrase or	her)
an adjective phrase	80. 定期的运动让他... (Regular exercise makes him)

Appendix II Questionnaire

Student number		Grade & Class	
Male <input type="checkbox"/>	Female <input type="checkbox"/>	Nationality	

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

1.	2.	3.	4.
----	----	----	----

(2) When did you begin formal English learning, e.g., preschool, grade 3?

(3) Do your parents speak English? Yes No

(4) Have you had any experience abroad? If yes, please specify which countries and how long. _____

(5) On a scale from 1 to 5, please select and check your level of proficiency in English skills compared with the students in your age.

	1 - low	2 - lower than average	3 - average	4 - higher than average	5 - high
listening					
speaking					
reading					
writing					

Appendix III One Sample of the Booklet

(Cut along the dotted line)

句子补全任务

1. 请用中文填中文句子，用英文填英文句子，使它们变成完整的句子。例如：她是中学老师； He has a dog.
2. 请按序号顺序填写！
3. 尽快地填完所有的句子，但请确保句子合乎语法。完成此任务需 40 分钟左右。
4. 在任务过程中遇到不认识的单词可查询或提问。完成句子后，请继续完成末尾的问卷。

1. He has a red _____
2. The book in the bag _____
3. The mother gave the child _____
4. The actor sent _____
5. The yellow flower _____
6. The student can understand _____
7. The young man showed his father _____
8. The little girl handed _____
9. 好天气带给人 _____
10. The farmer offered his neighbor _____
11. The expressman (快递员) passed _____
12. She decided to _____
13. 学生在课上 _____
14. They are watching _____
15. The policeman lent the woman _____
16. The tourist showed _____
17. 所有学生完成了 _____

18. The house in the forest _____
19. The author sent him _____
20. The cashier(收银员) gave _____
21. The broken car _____
22. This boy stands _____
23. His teammate passed him _____
24. The farmer sold _____
25. 花引来了 _____
26. Their cousin lent them _____
27. The designer sent _____
28. 老师的鼓励 _____
29. The woman opened _____
30. The swimmer won _____
31. The reporter handed the musician _____
32. His uncle gave _____
33. 校长在开学典礼上 _____
34. She has beautiful _____
35. The son showed his parent _____

36. The teacher lent _____
37. His sister found _____
38. The nice woman _____
39. The president gave his daughter _____
40. The business man offered _____
41. The computer on the table _____
42. 快递员递给学生 _____
43. The handsome boy showed _____
44. The guard closes _____
45. 阳光洒在 _____
46. The girl wrote _____
47. 她的朋友寄给她 _____
48. The brave captain gave _____
49. The cat is looking for _____
50. The writer finished his _____
51. 药店老板递给他 _____
52. The smart farmer sold _____
53. The house is made of _____
54. His grandpa went to _____
55. The hungry man was enjoying _____
56. 退伍老人展示给他孙子 _____
57. The great father handed _____
58. 队伍开始 _____
59. 经理送给顾客 _____
60. The volunteer offered _____
61. 阅读可以 _____
62. She lost _____
63. 她借给室友 _____
64. A stranger passed _____
65. The children in the playground _____

66. The student finished _____
67. 父亲寄给他 _____
68. The driver showed _____
69. The dog was drinking _____
70. The Italian dancer _____
71. Different people have _____
72. 主持人传给她 _____
73. The photographer sent _____
74. The little birds fly _____
75. 店员卖给他 _____
76. The brave man offered _____
77. 定期的运动让他 _____
78. Her favorite color is _____
79. 辅导员提供给新生 _____
80. He lent _____
81. 街上的人们 _____
82. The bird on my shoulder _____
83. His grandmother lent his umbrella _____
84. The salesman sold _____
85. 他爽朗的笑声 _____
86. The kid was reading _____
87. He watched a good _____
88. The waiter passed a chair _____
89. His boss offered _____
90. 他在看 _____
91. The new cowboy _____
92. The waiter offered services _____
93. The teenager showed _____
94. My mother cooked a good _____

95. 敬业的员工 _____
96. His blue shirt _____
97. The stranger gave a boat ticket _____
98. The French singer lent _____
99. The boy played _____
100. The businessman sold a computer _____
101. The police offered _____
102. 百灵鸟在树上 _____
103. He wastes a lot of _____
104. Her aunt lent a plate _____
105. The customer gave _____
106. 他善于 _____
107. The girl wears _____
108. The apple on the tree _____
109. The hunter handed the rabbit _____
110. The football player passed _____
111. The lady liked _____
112. Grandfather showed the map _____
113. His classmate gave _____
114. 平和的心态让她 _____
115. The man drunk a cup of _____
116. The student sent an e-mail _____
117. The teenager handed _____
118. The little baby is eating _____
119. 过度的节食会 _____
120. The lawyer showed a photo _____
121. The writer sent _____
122. Her roommate can speak _____
123. 服务员递了份菜单 _____
124. His brother lent _____

125. The lady tried her best _____
126. 秘书发了一份文件 _____
127. The doorman offered _____
128. The sky is _____
129. He gets a great _____
130. The sand in his shoes _____
131. 设计师展示了她的最新作品 _____
132. The painter showed _____
133. The new year _____
134. The popular singer plays _____
135. 房东借了一张被子 _____
136. The engineer gave _____
137. 猫爬到了 _____
138. The farmer is waiting for his _____
139. 船长递了一个救生圈 _____
140. The old man gave _____
141. His smile is _____
142. The chicken under the desk _____
143. 求职者投了他的简历 _____
144. The basketball player passed _____
145. The orange tree _____
146. Her big eyes _____
147. The teacher in the office _____
148. 粉丝展示了她的礼物 _____
149. The wife handed _____
150. 乘客在车站 _____
151. 毕业生送了他的单车 _____
152. His foreign friend sent _____
153. The phone on the chair _____
154. The man didn't remember _____

155. 代理商提供了一个样本 _____
156. The children showed _____
157. His 3-year-old sister _____
158. Her family supports _____
159. 班长发了一份英语学报 _____
160. The American writer sold _____

感谢您的参与!

问 卷

学生号		年级 & 班级	
男 <input type="checkbox"/>	女 <input type="checkbox"/>	国籍	

(1)请按掌握程度列出你会的所有语言(从高到低)

1.	2.	3.	4.
----	----	----	----

(2)什么时候开始正式地学习英语, 比如幼儿

园, 三年级? _____

(3)你的父母有任一方会说英语吗? 会 不会

(4)你有任何国外的经历吗? 如果有请说明国家

和逗留时长。 _____

(5)参照你周围同龄人的英语水平, 如果按 1 到 5

分, 请评价你自己的英语四项技能水平, 在相应

的格内打勾。

	1 - 低	2 - 低于平均 水平	3 - 平均 水平	4 - 高于平 均水平	5 - 高
听					
说					
读					
写					