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CROSS-LINGUISTIC SYNTACTIC PRIMING EFFECTS IN SENTENCE COMPREHENSION: A STUDY WITH BRAZILIAN PORTUGUESE-BILINGUALS

Dissertação submetida ao Programa de Pós-Graduação em Inglês: Estudos Linguísticos e Literários da Universidade Federal de Santa Catarina para a obtenção do grau de Mestre em Inglês: Estudos Linguísticos e Literários.
Orientadora: Prof.ª Dra. Mailce Borges Mota.

Florianópolis
2018

Ficha de identificação da obra elaborada pelo autor,
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Felicio, Adriana Rocha
Cross-linguistic syntactic priming effects in sentence comprehension : a study with Brazilian Portuguese-English bilinguals / Adriana Rocha Felicio ; orientadora, Mailce Borges Mota, 2018.
58 p.

Dissertação (mestrado) - Universidade Federal de Santa Catarina, Centro de Comunicação e Expressão, Programa de Pós-Graduação em Inglês: Estudos Linguísticos e Literários, Florianópolis, 2018.

Inclui referências.

1. Inglês: Estudos Linguísticos e Literários. 2. Psycholinguistics. 3. Syntactic priming. 4. Passive voice. 5. Syntactic processing. I. Mota, Mailce Borges. II. Universidade Federal de Santa Catarina. Programa de Pós-Graduação em Inglês: Estudos Linguísticos e Literários. III. Título.

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Esta Dissertação foi julgada adequada para obtenção do Título de "Mestre em Inglês: Estudos Linguísticos e Literários.", e aprovada em sua forma final pelo Programa de Pós-Graduação em Inglês: Estudos Linguísticos e Literários.

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To everyone who believed I could do it.

ACKNOWLEDGEMENTS

This has been a wonderful journey and there are so many people who I would like to thank.

My advisor, Mailce Borges Mota, who has taught and believed in me as an academic and a professional. I took one of her classes in 2015 as an audit student at PPGI and that surely changed my academic path for the better. Thank you, professor. This work is the way it is because you really pushed me forward to do the best I can.

The members of LabLing, who are more than colleagues to me: Daniela Brito, Daniele Wisintainer, Julia Justino, Anna Belavina Kuerten and João Luiz Coelho. Thank you for all the support throughout my MA, the discussions, study sessions, get-togethers for stimuli production, all the hugs and laughs we shared, thank you for everything. I would like to give a special thank you to Dani B, who I met in 2015 in Mailce's class, and who since then has helped me to become a better professional, being an inspiration to me, besides being a great friend. A special thank you to Anna for helping me with the statistical part of this study and for always being so kind and patient in sharing all her knowledge.

My friend, Monica Monawar, whom I became friends with in the last months after taking a class together. More than being a great professional that inspires me, we share an affection for Asian stuff. Thank you for all the gyozas and Kpop chats.

My parents, Marlene and Edson, who have always supported me and believed in me, no matter what I decide to study or what kind of journey I am about to endure.

My beautiful cousin, Eloise Rocha Colombo, who is more than a relative to me. Thank you for always being by my side and encouraging me to do my best and to not give up on the dreams we have.

My amazing boyfriend, João Martins, who kindly encouraged me and gave me support during the last step of this journey. A special thank you for preparing Figure 1, which I put in my Method Chapter (he made it in like less than 5 minutes). I am very thankful for the times he said words of encouragement and reminded me to have my goals in mind during the tough times.

A warm and special thank you for the incredible Masters of the Universe group! A group of support, encouragement, laughs and understanding. You guys were very important during this 2-year journey. Friends for and beyond academia. I love you all.

A big thank you to the special Fulbright friends I made during my FLTA experience some years ago. You guys from CdM group are always there for me and I love all of you.

I special thank you for the friends who do not share life in academia with me. They have experienced my craziness and anxiety and all the moments that I had to work instead of seeing them. Still, they loved me and were there for the times I needed.

I also want to thank my participants, who volunteered to take part in my experiment. They were sure a big part of this process.

Finally, I also want to thank CAPES for the financial support, as well as LabLing and PPGI for all the help throughout this two-year MA journey.

Do the best you can until you know better.
Then when you know better, do better.
Maya Angelou

ABSTRACT

The organization of syntactic systems in bilingual individuals has been a topic of great discussion in the field of psycholinguistics. The debate relies on the level of dependency of syntactic processing between languages in bilinguals, in which the second language (L2) could have shared representations with the first language (L1) (Hartsuiker et al., 2004) or be completely independent of it (Ullman, 2001). The paradigm of syntactic priming has been widely studied in this context. This paradigm refers to a cognitive phenomenon about the tendency of speakers to repeat their own syntactic constructions and those of their interlocutors along the sentences (Bock, 1986), and it provides evidence of how the syntactic constructions we use are represented and stored (Hartsuiker et al., 2004; Tooley & Traxler, 2010). The effects of this paradigm were first found during production. However, the phenomenon of syntactic priming has been found in comprehension as well. In comprehension, the participant is presented with a sentence (prime) followed by another sentence with the same or with a similar structure. Syntactic priming takes place when there is a reduction in the processing time of the target sentence (target) of same or similar structure. In this context, the present study investigated the effects of cross-linguistic syntactic priming in Brazilian-Portuguese (L1) and English (L2) during the comprehension of sentences in the passive voice. Thirty Brazilian Portuguese (L1)-English (L2) bilinguals performed a self-paced reading task consisting of 4 conditions. In all conditions, prime sentences were in Brazilian-Portuguese (BP) and target sentences were in English. Condition 1 consisted of 20 pairs of BP passive sentences and their translation equivalents in English as targets. Condition 2 consisted of 20 pairs of prime-target sentences in which the prime was a BP passive and the target was a different passive sentence in English. Condition 3, in turn, consisted of 20 pairs of prime-target sentences in which the prime was a BP active and the target was its translation as an English passive. Finally, Condition 4 consisted of 20 pairs of prime-target sentences in which the prime was a BP active and the target was an unrelated passive in English. The results of a paired-samples t-test showed a statistically significant reduction in reading time of the *by*-preposition and of the region of interest of passive voice (verb to be + main verb + by-preposition) in Condition 1. These results were interpreted as evidence in favor of the integration of the syntactic systems of L1 and L2 and, therefore, in favor of lexicon shared-syntax theories (Hartsuiker et al., 2004).

Keywords: Psycholinguistics. Syntactic priming. Passive voice. Syntactic processing.

RESUMO

A organização dos sistemas sintáticos em indivíduos bilíngues tem sido um tópico de grande discussão na área da psicolinguística. A discussão refere-se ao nível de dependência do processamento sintático entre idiomas em indivíduos bilíngues, podendo a segunda língua (L2) ter representação compartilhada com a primeira língua (L1) (HARTSUIKER et al., 2004) ou ser totalmente independente desta (ULLMAN, 2001). O paradigma do *priming* sintático tem sido amplamente estudado nesse contexto. Este paradigma refere-se a um fenômeno cognitivo sobre a tendência dos falantes de repetir as próprias construções sintáticas e as de seus interlocutores ao longo das sentenças (BOCK, 1986), e fornece evidência de como as construções sintáticas que usamos são representadas e armazenadas (HARTSUIKER et al, 2004; TOOLEY; TRAXLER, 2010). Efeitos desse paradigma foram encontrados durante a produção, porém é possível observar esse fenômeno na compreensão também. Na compreensão, o indivíduo é exposto a uma sentença (*prime*) precedida por outras com a mesma estrutura ou estrutura similar. O *priming* sintático ocorre quando há redução no tempo de processamento da sentença alvo (*target)* de mesma estrutura. Neste cenário, este estudo buscou investigar os efeitos do *priming* sintático translinguístico no processamento de sentenças em português (L1) e inglês (L2) utilizando a voz passiva como estrutura de interesse. Trinta bilingues do par português (L1) e inglês (L2) realizaram um experimento comportamental de leitura auto-monitorada que consistia de 4 condições. Todas as sentenças *prime* eram em português e as sentenças *target* eram em inglês. A Condição 1 consistia de 20 pares de sentença *prime-target* sendo uma sentença passiva em português como *prime* e sua tradução equivalente em inglês na voz passiva como *target.* A Condição 2 consistia de 20 pares de sentença *prime-target* sendo uma sentença passiva em português como *prime* e uma sentença diferente na voz passiva em inglês como target. A Condição 3, em contrapartida, consistia de 20 pares de sentença *prime-target* sendo uma sentença ativa em português como *prime* e sua tradução equivalente para a voz passiva em inglês como *target*. Por último, a Condição 4 consistia de de 20 pares de sentença *prime-target* sendo uma sentença ativa em português como *prime* e uma sentença diferente na voz passiva em inglês como *target*. Os resultados do teste t para amostras pareadas mostraram um redução estatisticamente significante no tempo de leitura na preposição pelo/a e na região de interesse da voz passiva (verbo ser + verbo principal + preposição pelo/a) na Condição 1. Os resultados foram interpretados como uma evidência em favor da

integração dos sistemas sintáticos da L1 e da L1 e, dessa forma, em favor de teorias lexicalistas de representação sintática compartilhada (HARTSUIKER et al., 2004).

Palavras-chave: Psicolinguística. Priming sintático. Voz passiva. Processamento sintático.

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LIST OF ABBREVIATIONS AND SYMBOLS

BP – Native Speakers of Brazilian Portuguese (nonnative speakers of English)
CEFR – Common European Framework of Reference for Languages
CEPSH/UFSC – Comitê de Ética em Pesquisa com Seres Humanos
COCA – Corpus of Contemporary American English
DP – Declarative/Procedural
ERP/EEG – Event-Related Potentials/Electroencephalogram
fMRI – Functional Magnetic Resonance Imaging
L1 – First Language
L2 – Second Language
LabLing – Laboratório da Linguagem e Processos Cognitivos (Laboratory of Language and Cognitive Processes)
M – Mean
MUC – Memory, Unification, Combination
ms – Milliseconds
N – Number of Participants
RC – Relative Clause
RT – Reading Time
SD – Standard Deviation

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1. INTRODUCTION

Cognitive and linguistic processes involved in second language (L2) learning[1] have attracted attention due to their particularities in language and mind. Research has focused not only on matters involving teaching methods and how to overcome limitations in learning, but also on the cognitive advantages of being bilingual. The difficulties of learning and processing an L2 have also been investigated. Syntactic processing has been claimed to pose difficulties for L2 learners (Hahne, 2001; Hahne & Friederici, 2001; Weber-Fox & Neville, 1996). Some L2 difficulties relate to comprehending a message by unifying lexical information with the structure of the language under learning (Scherer, Fonseca, Amiri, Adrover-Roig, Marcotte, Giroux, Senhadji, Benali, Lesage, Ansaldo, 2012).

Thus, the investigation of syntactic processing can improve our understanding of the mechanisms and factors related to the processing of a second language. One of the issues researchers have been interested in is related to how the L1 and L2 syntactic systems are organized in bilingual individuals. Syntactic processing of L2 could be independent of L1 (Ullman, 2001, 2013), at least at lower levels of proficiency, or have shared grammatical representations with L1 (Hartsuiker & Pickering, 2008). On another view, MacWhinney (2005) asserts that when there are some similarities in the syntactic systems of the L1 and the L2, syntactic codes can be transferred from the L1 to the L2, but if there are different syntactic rules, cross-linguistic transfer does not take place.

The present study aims to investigate L2 syntactic processing by focusing on cross-linguistic syntactic priming in order to gain a better understanding of how the two syntactic systems are organized in bilingual individuals: is the syntax of the L1 represented and processed separately from the syntax of the L2 or is syntax shared between L1 and L2 in these speakers? To investigate this issue, the psycholinguistic paradigm of syntactic priming will be adopted by means of a sentence comprehension task performed by a population of 30 Brazilian Portuguese (henceforth, BP) speakers of English as L2. Syntactic priming refers to the facilitation in the processing of syntactic forms that were previously encountered (Hartsuiker, Pickering, & Veltkamp, 2004). In the present study, the target structure of interest is the passive voice. The specific objectives of the study are: (1) to investigate whether there are effects of syntactic

[1] In this work, I will use the words "learning" and "acquisition" interchangeably to refer to the learning of a second language.

priming from L1 Portuguese on L2 English, and (2) if so, to examine the effects of lexical repetition on syntactic priming.

1.1. SIGNIFICANCE OF THE STUDY

Studies about the underpinnings of language have helped researchers to gain knowledge not only about language but also about the cognitive system that supports language acquisition and processing. In this endeavor, the research on bilingualism and on how two or more languages coexist in one cognitive architecture has been of great relevance. The debate whether a syntactic structure can facilitate the processing of the same structure in another language has provided insights of syntactic organization in bilinguals (Loebell & Bock, 2003; Bernolet, Hartsuiker, & Pickering, 2013; Hartsuiker, Beerts, Loncke, Desmet, & Bernolet, 2016; Hartsuiker & Bernolet, 2017). There is evidence showing that L1 and L2 systems have shared syntactic representations (Bernolet, Collina, & Hartsuiker, 2016; Hartsuiker et al., 2004; Kidd, Tennat, & Nitschke, 2015; Weber & Indefrey, 2009). English has been investigated, either as L1 or L2, with other languages (e.g., Germanic languages: Loebell & Bock, 2003; Weber & Indefrey, 2009; Spanish: Hartsuiker et al., 2004; French: Hartsuiker et al, 2016; Polish: Fleischer, Pickering & McLean, 2012; Korean: Shin & Christianson, 2009). The syntactic priming paradigm has been adopted in the investigation of syntactic processing in BP monolinguals (e.g., Kramer, 2017; Kuerten, 2017; Teixeira, 2016). However, to the best of my knowledge, there are no studies that have investigated syntactic processing in BP-English bilinguals in the syntactic priming paradigm. Hence, this study will provide insights to the organization of the syntactic systems of this language pair and may contribute to the discussion of bilinguals' sentence processing, in general, and of BP-English speakers, in particular.

1.2. ORGANIZATION OF THE PRESENT WORK

This work is divided into 5 chapters. In chapter 2, I present the theoretical background on which the study is based, by focusing on syntactic processing within the priming paradigm in experimental psycholinguistic studies, and on a brief description of the structure chosen for the investigation of syntactic processing, the passive voice. In chapter 3, I present the method of the study and the research questions and hypotheses that were addressed in the thesis. I also describe the instruments and the research design of the experiment that was conducted

in order to fulfill the objectives of the study. In chapter 4, I present the results and discussion of the experiment. Last, in chapter 5, I summarize the findings and discuss implications for further research.

2. REVIEW OF LITERATURE

The purpose of this section is to present a select review of the theoretical framework in which this research is based on. First, in section 2.1, I present the literature that supports the separate-syntax account, and then what has been found in the literature that could enlighten and support the discussion about the shared-syntax account. In subsection 2.1.1, I present a definition of priming in psycholinguistic studies, and more narrowly, a review of syntactic priming evidence. Last, in section 2.2, I present a description of passive voice in English and BP.

2.1. SYNTACTIC PROCESSING

Much has been discussed about how syntax is represented in a bilingual's mind, but the field of bilingualism is still scarce in terms of findings and theoretical models about language development and language processing if compared to those about monolingualism (Grosjean, 1998). Grosjean (1998) posits that this scenario has much to do with the methodological procedures selected as conceptual theories within the research on bilingualism. The author stresses that a researcher interested in language development and processing in bilingualism has to deal with many aspects before engaging in any investigation in the field, making sure a number of variables are controlled to avoid interference in the results (Grosjean, 1998). Every bilingual has their own history of learning, their own bilingual experience. A major task, according to Grosjean (1998), is to define the type of bilingual one is investigating. Thus, for this study, I follow Grosjean's (1998) proposal that a bilingual is the individual who actively uses the two languages on a daily basis. That being defined, this section explores the debate on syntactic processing in bilinguals, and further information related to linguistic and biographical information of the participants of this study will be reported in Chapter 3.

Ullman (2001a, 2001b) presents the Declarative/Procedural (DP) model, which posits that both L1 and L2 depend on two memory systems: the declarative memory system and the procedural memory system. The declarative memory system underlies the learning, representation, and use of knowledge about facts and events. It is a system responsible for arbitrary information, such as form-meaning relationships. The knowledge from this system is learned rapidly and is partly explicit (Ullman, 2001b). The procedural memory system, on the other hand, is implicated in the learning and control of implicit motor and cognitive

skills (Ullman, 2001a), and actions that people do not truly realize they know how to perform. The knowledge learned in this system is partly specialized in sequences and rules, and it needs prolonged practice (Ullman, 2013).

The DP model asserts that in L1, the learning and use of grammar relies on procedural memory, while the knowledge and use of words depend on declarative memory (Ullman, 2001a). Early learners of L2 can count on procedural memory for grammar aspects, so they still learn implicitly, but late learners tend to count on declarative memory for the same functions, since procedural memory is decreased in adults (Ullman, 2001a, 2013). Thus, not only can knowledge from one memory system shift to another, but as the years pass by, the more internalized the L1 system is, the stronger the impact of L1 over the L2 system (Hernandez, Li, & MacWhinney, 2005; Piske, MacKay, & Flege, 2001).

The DP model makes specific predictions about the interaction of L1 and L2 in terms of processing. Another neurocognitive framework for language processing is the Memory, Unification and Control Model (MUC), proposed by Hagoort (2003, 2005, 2013, 2016, 2017). The Model consists of 3 functional components (Hagoort, 2013). The Memory component, the only language-specific component of the Model, stores information of linguistic nature – word form, word meanings and syntactic templates (Hagoort, 2017) – as well as the operations regarding language retrieval. The Unification component allows for the combination of the lexical information in the Memory component into linguistic structures so that meaning can be expressed (Hagoort, 2013). Hagoort (2003, 2005, 2013, 2016, 2017) terms this process of combination Unification and argues that Unification takes place not only at the syntactic level, but also at semantic and phonological levels. The Control component is in charge of the executive control demanded during language use, when the speaker needs, for instance, to select the language in which the message will be conveyed, to take into consideration background and shared knowledge or to handle social interaction. The MUC framework applies to both production and comprehension. In its current version, the MUC model does not make specific predictions about L2 acquisition and processing, but it is important to the purposes of the present study because in the model, syntactic processing is lexically driven, in the sense that when the Unification component selects the retrieved lexical information from memory to produce a sentence, for example, its encoded syntactic properties are also activated (Hagoort, 2005). That is, the MUC assumes that syntactic and lexical processing are interrelated.

In terms of L2 processing, Pickering and Branigan (1998) proposed a model of language production that was later adapted to bilinguals by Hartuiker et al. (2004). Pickering and Branigan's (1998) account proposed that lemma nodes (the base of each word) are connected to combinatorial nodes that encode syntactic properties, which are categorical nodes (e.g., noun, verb, preposition) and featural nodes (e.g., gender, number). The combinatorial nodes specify the combinatorial properties of a lemma and the ways it can be used in a grammatical construction. For the bilingual account, lemmas for translation equivalents are connected to the same conceptual nodes. Thus, when a verb is used in a passive sentence, for example, it activates cross-linguistically the passive combinatorial node and consequently increases the likelihood to produce a passive, whether in one's first or second language (Hartsuiker et al., 2004).

A bilingual individual stores the syntactic information of both languages and accounts of language processing have discussed how the syntax of the two languages are organized in one's mind. The separate-syntax account posits that although two languages have similar grammatical structures, they are represented separately. To a certain extent, that would benefit the speaker, because the languages would be processed efficiently one at a time (i.e., when shifting to the L2 in an L1 environment) without having any interference whatsoever (Hartsuiker et al., 2004). On the other hand, for the shared-syntax account, languages with similar structures have the rules represented once. Having one representation for syntactic similarities reduces processing and even with differences in the languages, bilinguals would store the shared representations once, whereas other grammar aspects would be stored when necessary (Hartsuiker et al., 2004).

The language models and views of system integration in bilinguals give us insights about theories in language acquisition and processing. Thanks to experimental research, it is possible to test the fundamentals of these theories. Experimental research can shed light on the processing of structural-information representations at the moment they are being processed (Kaiser, 2015). Different psycholinguistic methods, including reaction time-based measures, have been used to investigate language comprehension. Reaction-time-based measures permit to compute for how long and how fast people take to perform different sets of actions or tasks, consequently allowing researchers to enlighten the discussion on language processing. The lexical-decision paradigm is an example of a method that measures the reaction time when participants hear or see a word and then are asked to indicate (usually by pressing a button/key)

whether the word is real under the language and the topic being studied (Kaiser, 2015).

Another example of reaction time-based measures, and the one applied in this study, is self-paced reading. In self-paced reading, participants control the speed of their reading by pressing a key to unveil the word/sentence one by one along the segment under experimentation. When exposed to a sentence, for example, participants only see one word at a time and are unable to go back to the previous word or to see the whole sentence after its presentation. This type of exposure allows the measurement of how much time a participant takes on each word. Different presentation designs (word-by-word, sentence-by-sentence, clause-by-clause, for instance) can provide distinct levels of information and insights, as increased reading times have been related to processing difficulties (Kaiser, 2015). Self-paced reading has been adopted to investigate structural-information processing and, like other reaction time-based measures, it can provide many insights on language structure (Kaiser, 2015).

Regardless of the reaction-time-based measure the researcher chooses to use, it is important to create a well-designed experiment in which the information structure being investigated is compared to a control condition (Kaiser, 2015), thus, providing a reliable result.

Summarizing, after the researcher chooses the best experimental method to shed light on theories and accounts of language processing and acquisition, it is possible to analyze the results under any theory, thus providing insights on the topic studied.

In the next section, an overview of studies and experiments related to L2 syntactic processing within the priming paradigm will be presented.

2.1.1. Syntactic Priming in Bilingual Language Processing

Priming is the phenomenon in which previous exposure to a given stimulus may influence the response to a later stimulus (Bock, 1986; Bock & Griffin, 2000; Ferreira & Bock, 2006; Ledoux, Traxler and Swaab, 2007). The exposure to a series of semantically related words can be an example of semantic priming. For instance, after the presentation of a prime stimulus (e.g., dog) in written, oral or visual form, there is a facilitation in the processing of the next related word (e.g., cat) (e.g., Dell'Acqua & Grainger, 1999; Gulan & Valerjev, 2010; Franklin, Dien, Neely, Huber, & Waterson, 2007). This facilitation is evident, for instance, in faster reaction times.

Another type of priming is syntactic priming, which relates to the speaker's tendency to use similar or the same forms they have recently experienced (Ferreira & Bock, 2006; Hartsuiker et al., 2004; Hartsuiker & Bernolet, 2017; Schoonbaert, Hartsuiker, & Pickering, 2007). The term was first introduced by Bock (1986), who found that being exposed to a particular syntactic structure increased the production of the same form. Bock (1986) conducted a study about syntactic persistence in English language production with a group of students from American universities. In her experiment, there were two types of priming sentences: transitive sentences – in the active and passive voice – and dative sentences. Participants were presented with either a transitive or a dative sentence and asked to repeat it. Afterwards, they saw an event depicted in a picture and were asked to describe it by formulating a sentence. The results showed that participants described the picture using the same syntactic form they were previously exposed to in the prime sentence. Bock's (1986) study also showed that repetition of syntactic structures occurred either when there was human or non-human agency in the sentences.

However, even when the situations are not experimental, subjects can still be primed. Prior to Bock's (1986) study, Levelt and Kelter (1982) showed the effects of repetition in a naturalistic question-answering situation. Speakers who were asked the time with a prepositional form of question (e.g., at what time do you…?) answered with a preposition (e.g., at 7 am), while the speakers who were asked the time with a non-prepositional form of question (e.g., what time do you…?) did not answer with a preposition (e.g., 7 am). Moreover, Weiner and Labov (1983) found that in a spontaneous speech situation, speakers produced passive sentences after hearing the same syntactic feature in a previous utterance. For Bock (1986), priming in production can be interpreted as a cognitive activation phenomenon related to previous information. The speakers chose to use the same grammatical form of their interlocutors because its syntactic representation was recently activated, more than an alternative structure.

Syntactic priming has been used to enlarge the discussion about how syntax is acquired and represented (e.g., Hartsuiker et al., 2004, Branigan & Pickering, 2016). It can be viewed as evidence of how the structures we use are stored (Tooley & Traxler, 2010), since priming has been shown to facilitate the production and comprehension of the same sentence structure (Branigan & Pickering, 2016). Therefore, if processing a stimulus can affect the subsequent stimulus, then these stimuli share some aspect of representation (Branigan & Pickering, 2016). Most syntactic priming experiments in production relate to choices between

alternative structures, and the effects are shown regardless of thematic roles, semantic differences, shared lexical or phonological content (Branigan & Pickering, 2016).

In the comprehension modality, Branigan, Pickering, and McLean (2005) investigated ambiguity resolution in a picture matching task by means of the priming paradigm in a group of English native speakers. These authors conducted a syntactic priming experiment with prepositional phrases (PP) whose attachments were ambiguous. A sentence like "the waitress prodding the clown with the umbrella" (Branigan et al., 2005, p. 469) has a PP "with the umbrella" that ambiguously lead to a high attachment, meaning that the waitress used the umbrella to prod the clown, and a low attachment, meaning that the waitress prodded the clown who had the umbrella. In their study with a picture matching task, participants first read the PP, then saw two pictures describing the sentence and were asked to choose one that matched the action. On a prime trial, there was a picture with either a low or high attachment interpretation and another picture with neither of these interpretations, whereas the target trial had one picture with a low attachment and one with a high attachment. On the target trials, participants could freely choose either of the pictures, but since they were previously primed with a certain attachment, the results showed that participants were efficiently primed in choosing the picture that corresponded to the low or high attachment they were exposed to.

Various studies have shown that reading sentences with the same syntactic structure can reduce the cost of the processing involved in the comprehension of subsequent sentences (Ledoux et al., 2007; Branigan, Pickering, Liversedge, Stewart, Urbach, 1995; Weber & Indefrey, 2009). The reduction in the time taken to process the sentence can be intensified by a word that is in both target and prime sentences (e.g., a noun or a verb). This reduction in reaction time during priming is called "lexical boost" (Tooley & Traxler, 2010) and may indicate shared lexical representation between languages, more than shared syntactic representations. To control for the lexical boost in syntactic priming, it is necessary to control for word repetitions in sentences. In Branigan et al.'s (2005) study, priming occurred when prime and target sentences shared the same verbs, whereas when the verbs were different between prime and target, the priming effect was not significant. Hence, one assumption is that priming in comprehension depends on this lexical repetition (Branigan et al., 2005). Overall, data from priming in comprehension is more limited than in production (Branigan & Pickering, 2016), and the literature has shown that priming is boosted by lexical repetition

(Branigan & Pickering, 2016; Ledoux et al., 2007; Schoonbaert et al., 2009). Next, I move to the investigation of priming in L2 processing.

In a bilingual context, priming is likely to occur when the two languages have similar syntactic structure (Hartsuiker et al., 2004). The shared-syntax account foresees to cross-linguistic syntactic priming, while the separate-syntax account does not (Hartsuiker et al., 2004), since, according to the DP model, syntactic priming would occur easily within language, as the grammatical knowledge of one language remains in a unique separate memory system from the other: the L2 grammatical knowledge relies on the declarative memory system, while the L1 grammatical knowledge relies in the procedural memory system.

The literature about syntactic priming with bilinguals has mainly focused on the production modality. I now review a selection of 3 cross-linguistic studies on production, since this modality has been investigated most exclusively within the discussion of language processing, and their findings have contributed to models of language comprehension as well. Then, I move to a review of 3 cross-linguistic studies on comprehension. These specific studies were selected due to their findings being relevant to the literature of cross-linguistic syntactic priming.

The first study to test cross-linguistic syntactic priming in production was conducted by Loebell and Bock, in 2003. They investigated the likelihood of syntactic priming to occur in fluent German-English bilinguals with syntactic structures that already showed priming effects in English (Loebell & Bock, 2003). The authors compared structures that have the same structural configuration for both German and English (ditransitive and prepositional datives), and they also compared transitive sentences (active and passive), in which one form (passive) is different between languages. In priming trials, participants first heard a sentence and had to repeat it out loud in the sequence, and then they were shown a picture they had to describe. Sentences were always presented and repeated in one language, and pictures were described in the other language. Participants were 48 German native speakers, who were tested in both directions. They first heard and repeated a sentence in German and produced another in English, and vice-versa. The German sentences were translations of the English primes and fillers, but the pictures they described represented different verb actions from their prime sentences. The results of this study showed priming effects for double-object datives, which have the same structural configuration for both languages, whereas for passive sentences the effect was weak. Loebell and Bock (2003) claimed that structural differences

between languages played a significant role in these results by preventing priming to happen.

Under the view of the shared-syntax account, cross-linguistic syntactic priming was investigated by Hartsuiker et al. (2004) with a population of 24 Spanish-English adult bilinguals. In Hartuisker et al. (2004) priming was taken as evidence of shared syntactic representations, both in production and comprehension, in the context of language in use. The participants sat in front of a person disguised as another participant, and they were both asked to describe pictures from a box of cards each one of them had. The participant had a box with images, while the disguised participant had scripted sentences printed on the cards. The disguised participant pretended to describe the pictures, but he was, in fact, reading Spanish sentences on a specific card he had. Next, the naïve participant had to describe a picture that was in a different card using the English language. There were four different prime sentences in Hartsuiker et al.' (2004) study transitive sentences in the active and passive voice, intransitive sentences, and OVS (object-verb-subject), a form that only exists in Spanish. The verbs and nouns were not translation equivalents.

The results of Hartsuiker et al.'s (2004) experiment showed cross-linguistic─syntactic priming in Spanish-English bilinguals during production. Bilinguals produced English passive sentences more often following Spanish passive sentences than Spanish active or intransitive sentences. Hartsuiker et al., (2004) interpreted the results of their study under the view of language production theories. These theories predict that the sentence frame is built along its production by associating lexical entries to their syntactic information (Hartsuiker et al., 2004).

Research has shown that bilinguals indeed have shared lexical representations, while bilingual syntax is still a matter of investigation. Hartsuiker et al. (2004) pointed out that the syntax of a structure may be shared in two languages if it is formed in the same way. Contrasting to one of Loebell and Bock's (2003) experiments, in which they tested German-English bilinguals with passive structure as well, but priming was not found. The separate syntax view predicts a stronger effect of priming within language as compared to priming across languages. As postulated by Ullman (2001), the two syntactic systems rely on two different memory systems in late proficient learners. Therefore, if we expect syntactic priming effects from L1 to L2 under this view, it is more likely to occur an interaction within procedural memory (L1-L1), than between the declarative and procedural memory systems (L1-L2) (Hartsuiker et al., 2016). On the other hand, the shared-syntax view still predicts a strong effect of priming within language as much as between

languages, and the syntactic systems will share representations as long as the speaker has sufficient proficiency in the L2 (Hartsuiker et al., 2016).

In Bernolet, Hartsuiker, and Pickering's (2007) sentence production study involving within and between languages syntactic priming as well, Dutch (L1) was paired with two different second languages, English and German, to test the significance of word order. Priming within languages was still stronger than between languages, no matter which language was tested in the experiments. However, in the cross-linguistic experiments, they found that word order indeed plays a role in the paradigm. It was not possible to find a significant priming effect between Dutch and English, since relative clause structures do not share the same word order in the two languages. On the other hand, when priming the structure in Dutch-German, cross-linguistic effects were found, both with translation equivalents in prime and target sentences and with different nouns.

Summarizing, the production studies on cross-linguistic syntactic priming have shown that the language systems under investigation can prime structures on another, and although lexical repetition is not the rule for that to happen, the effects were always increased when translation equivalents were used. Participants' proficiency also seems to be significant. I now move the review to the comprehension modality in L2.

From the perspective of language production to that of comprehension, Weber and Indefrey (2009) were the first authors to investigate syntactic priming in comprehension with a bilingual population. English-German bilinguals were selected due to being well-studied languages within the psycholinguistic paradigm (Weber & Indefrey, 2009; see Bock, 1986; Loebell & Bock, 2003; Bernolet et al., 2007 for further evidence), as well as the syntactic structure of passive voice. The participants were 16 adult late-acquisition bilinguals of medium English proficiency who were tested between languages (L1-L2) and within language (L2-L2) in a self-paced reading experiment. Another 19 adult late-acquisition participants of medium English proficiency were also tested between languages during a functional magnetic resonance imaging (fMRI) to investigate whether these two languages share the same neural substrates. For both methodological approaches, the within-language condition had the same verbs, whereas, in the cross-linguistic condition, the verbs were translated between sentences to boost priming effect.

The behavioral method of Weber and Indefrey's (2009) study consisted of a self-paced reading experiment, in which the participant was presented with a prime sentence followed by the target sentence. The

mean reading time of experimental sentences was calculated from the third word onwards between languages, the point where passive structure in both languages become different. Even though German and English differ in terms of word order for passive sentences, syntactic priming was found in comprehension. Therefore, for Weber and Indefrey (2009), their behavioral results showed that it is not just a mere word order interaction between L1 and L2, but a more abstract representation of these two syntactic systems. Moreover, data from the fMRI experiment showed brain activation on the same areas for German and English sentence processing. Thus, the authors conclude these two systems are integrated under the view of shared-syntax and that verb repetition seemed to be significant in the results.

Kidd et al. (2015) investigated syntactic priming in comprehension in a picture matching task with English-German bilinguals. Twenty-seven participants were recruited to take part in an experiment that investigated shared abstract representation in unambiguous subject and object relative clause (RC) structures. Participants had to read sentences on a computer screen and then select one picture between two choices that were depicting the sentence. English object RCs primed object RC interpretations of ambiguous German RCs, but English subject RCs did not prime subject RC interpretations. Their results were sensitive to word order overlap between languages, and they argued that the findings support the lexicon-syntactic model of syntactic representation (Kidd et al., 2015).

Cross-linguistic syntactic priming in comprehension was also investigated with a population of Chinese-English bilinguals by Hsieh (2016). Fifty-four participants with medium proficiency in English went through a self-paced reading experiment to investigate whether Chinese passive RCs could influence the processing of ambiguous English sentences. Participants were tested with and without verb repetition, and the results showed that priming in comprehension occurred without lexical and word order overlap between prime and target sentences. Also, translation equivalents did not boost priming. For this reason, Hsieh (2016) concluded that representation and processing in bilinguals are shared but abstract in nature, rather than lexically driven.

Summarizing, syntactic priming effects provide evidence for syntactic representation and interaction in bilinguals. The data from priming in comprehension is less conclusive than from production (Branigan & Pickering, 2016), but priming can provide information regarding structure representation in the absence of alternatives (i.e., when choosing to produce a structure out of some alternatives) (Branigan

& Pickering, 2016). Overall, cross-linguistic studies show that word order plays a role in language integration, as well as translation equivalents.

In the next section, I present a description of passive voice, the target structure selected for the investigation of syntactic processing in this study with BP and English bilinguals.

2.2. DESCRIPTION OF THE PASSIVE VOICE IN BRAZILIAN PORTUGUESE AND NGLISH

This section aims at providing a general description of the passive voice in Brazilian Portuguese and in English. In doing so, I would like to emphasize that the purpose of the present study is not to investigate the processing of passive voice in and of itself, although this is certainly an objective to be achieved in the future. The main purpose of the present study is to investigate syntactic processing in bilinguals through the syntactic priming paradigm. For that, the passive voice was the target structure selected for two main reasons: (1) the effects of syntactic priming increase with less frequent structures (Ferreira & Bock, 2006), and the passive voice is considered to be less frequent due to its complexity compared to the canonical word order of active voice (Grodzinsky, 1986; Jaeger & Snider, 2007), and (2) the passive voice has been the target structure of previous syntactic priming studies, thus allowing for the comparison between the results of the present study and those of other studies.

According to Luft (2002), in the Brazilian Portuguese traditional grammar there are three verbal voices: active, passive, and reflexive. The active voice expresses the action one does, and the subject is the agent expressed by the verb: *o menino olhou a menina* [the boy saw the girl]. The passive voice expresses the action one receives, the subject is the patient expressed by the verb: *a menina foi olhada pelo menino* [the girl was seen by the boy]. In the reflexive voice, the subject is the agent and the patient of the verb at the same time, as in *o menino se olhou no espelho* [the boy saw himself in the mirror]. The passive voice can also be expressed in two ways: verbal passive (e.g, *o presente foi encontrado pela mãe* [the gift was found by the mother]) and pronominal passive (e.g., *vendem-se casas* [houses are sold]), whose configuration does not extend to English. Comparing English to BP, these two languages do not differ in terms of active and passive voice word order, so, this work will stick to the properties they share, the verbal passives.

Passive structures are considered complex sentences because of the characteristics they carry, which involve syntactic roles (subject-object),

semantic relations (agent and patient), and a pragmatic aspect of topicalization, the theme of the sentence (Gabriel, 2001). The subject agrees with the verb, the agent is the word that expresses the verb action, and the topic is the reference of discourse, usually the noun phrase (NP). In a general and frequent construction as the active voice, for instance, the subject, the agent and the topic are usually represented by the same argument, as in (1). The argument "dogs" agrees with the verb, it is the agent that expresses the action of the verb, and it is also the topic of the sentence. However, in a less frequent structure sentence such as the passive voice, represented in (2), the subject and the topic are represented by the same word (the food), but the agent, in this case, is "the dogs", which can be omitted.

(1) The dogs ate the food.

(2) The food was eaten (by the dogs).

The verb "to be" is a copulative verb, a verb that links the subject with the predicative, but, as in Estrela (2013), in the present study, I will call it auxiliary verb when discussing passive voice.

In English, there are two auxiliary verbs that are used in passive sentences: *to be* and *to get* (Alexiadou, 2005). In BP, the auxiliary verb that conveys the same meaning as in English is the verb *ser*. Therefore, for this study, I will utilize *be*-passives because the correspondence also exists in BP (action passives with *ser*). In both English and BP, the passive structure is formed by auxiliary be + the past participle of the verb. The passive voice is, in sum, the relation of thematic roles in the discourse with their syntactic roles (Estrela, 2013). The active voice results in the alignment of thematic roles and their syntactic roles (3). The opposite word order is defined as passive voice (4).

(3) The girl ate the cake.

A menina comeu o bolo.

(4) The cake was eaten by the girl.

O bolo foi comido pela menina.

Semantically, these sentences (3 and 4) have the same meaning. They share the same characteristics of tense, aspect, and modality. They also show the relation between "the girl" (*a menina)* and "the cake" (*o bolo)*. The noun that assumes the subject position in the active voice is the complement of the agent in the passive voice. In (4), a long passive construction is presented, with the by-phrase (represented by *pela*, in BP), as opposed to short passives, in which the thematic role is implicit (e.g., the window was opened). The semantic aspect is preserved in both (3) and (4): "the girl" is the agent, while "the cake" is the theme or the patient.

Not all verbs can work in a passive sentence because of their transitivity. Thus, in order to function in this structure, the verb must be transitive, or ditransitive (Estrela, 2013). The verb should have the syntactic properties that require a direct object. Otherwise, the sentences will not be accepted as passives – as in the examples below, taken from Estrela (2013, p.7) - when having ergative verbs (7), unaccusative verbs (8), and verbs which have prepositional internal arguments (9), when the verb meaning functions as an adjective.

(7) *O João foi trabalhado.* * [João was worked*.]

(8) *O João foi desmaiado*. * [João was fainted. *]

(9) *O trabalho foi interrompido.* * [The job was interrupted. *]

According to Koutamanis (2015), there are three aspects of passive structure that are relevant to the description of BP and English passives. The first parameter has to do with semantic reversibility. The sentence is reversible when the agent and patient can exchange positions, as in (10) and (11). Sentence (12) is not reversible, since the inversion of agent and patient is not semantically acceptable.

(10) The dog was chased by the cat.

(11) The cat was chased by the dog.

(12) The wall was painted by the man.

The second aspect refers to the presence of a by-phrase. Mostly, the agent of the passive can be omitted, forming a short passive, but the sentence would still be considered to be in the passive voice, as shown in (12).

(12) The wall was painted.

The third aspect has to do with the actionality of the main verb and its semantic property in the relation of agent vs. patient. In (13), a sentence with an action verb, “the man” is the subject of the sentence, but since (13) is in the passive voice, “the man” is also the patient affected by the action of the verb. However, “the police”, although semantically being the agent of the verb “to attack”, plays the syntactic role of object of the sentence. Non-action verbs (verbs that represent psychological processes, states, and perceptions) cannot be semantically reversible, since the verb does not represent a true action. In (14), “the movie” is affecting the agent in terms of experience, so sentence (15) would be ungrammatical

(13) The man was attacked by the police.

(14) The movie was seen by the man.

(15) The man was seen by the movie. *

This study used verbal passives with the by-phrase in the investigation of syntactic processing in BP-English bilinguals, since, as

previously exposed, verbal passives share the same properties and word order in both languages.

In the next chapter I will present the method employed to investigate cross-linguistic priming effects in BP-English bilinguals.

3. METHOD

The present chapter outlines the methodological procedures that were adopted in the present study for the behavioral experiment that was carried out. The chapter is organized into 6 sections. In section 3.1, the research questions and hypotheses are presented. In section 3.2, the profile of participants is described. In sections 3.3 and 3.4, respectively, the instruments used and the research design are presented. Section 3.5 describes the procedures of the experiment and section 3.6, the pilot study.

3.1. OBJECTIVES, RESEARCH QUESTIONS, AND HYPOTHESIS

The main objective of the present study is to investigate cross-linguistic syntactic processing in bilingual speakers of L1 Brazilian Portuguese (BP) and L2 English. The specific objectives of the study are: (1) to investigate whether there are effects of syntactic priming from L1 BP on L2 English, and (2) if so, to verify the effects of lexical repetition on syntactic priming.

In order to fulfill the objectives, the following research questions were addressed:

Research question 1: Are there syntactic priming effects of L1 (BP) on L2 (English)?

Research question 2: If so, to what extent does lexical repetition influence syntactic priming?

With the purpose of answering these research questions, and supported by the literature on syntactic processing within the priming paradigm (e.g., Bock, 1986; Bernolet et al., 2007; Hartsuiker et al., 2004; Ledoux et al., 2007; Weber & Indefrey, 2009, among others), the following hypotheses were pursued:

Hypothesis 1: There will be a significant syntactic priming effect of L1 BP on the processing of L2 English sentences in the passive voice.

Hypothesis 1 is based on studies that show that the L1 can affect L2 processing (e.g., Loebell & Bock, 2003; Pickering & McLean, 2012, Hartsuiker et al., 2004). Although most studies have focused on the production modality (e.g., Loebell & Bock, 2003; Hartsuiker et al., 2004; Schoonbaert et al., 2007; among others), other studies, such as Weber and Indefrey (2009), have reported priming effects from L1 to L2 in comprehension as well.

Hypothesis 2: There will be a significant syntactic priming effect of L1 BP on L2 English processing of passive voice during comprehension in the repeated structure condition.

Maintaining the same grammatical structure in a syntactic priming design will most likely induce a significant priming effect. For instance, Loebell and Bock (2003) showed that German datives prime the production of English datives; Hartsuiker et al. (2004) demonstrated that Spanish passives prime the production of passive English sentences and Pickering and McLean (2012), that Polish passive sentences primed the production of English passives.

Hypothesis 3: There will be a significant syntactic priming effect of L1 BP on L2 English processing of passive voice during comprehension in the translation equivalent condition.

The translation aspect has been shown to exert strong influence in the syntactic priming effect. Studies that included a condition with translation equivalents between prime and target showed a translation equivalence boost when this condition is compared to a no-translation condition (e.g., Bernolet et al. 2013; Schoonbaert et al. 2007; Cai et al., 2011).

3.2. PARTICIPANTS

To pursue the objectives of this study, a behavioral experiment was conducted with a group of native speakers of Brazilian Portuguese (BP), learners of English as L2. The participants were recruited through pamphlets placed in the campus area of the Federal University of Santa Catarina (UFSC), calls posted on some networking websites, and invitations sent to the undergraduate program of *Letras-Inglês* and to the advanced students from the English Course of the Extracurricular Language Program at UFSC. This study was approved by the Ethics Committee of UFSC (*Comitê de Ética em Pesquisa com Seres Humanos* - CEPSH) under number 1.512.973. All participants had to sign a consent form prior to taking part in the experiment (Appendix A) and no financial compensation was given for participation. Besides the consent form, participants answered a biographical questionnaire to make sure they all had a similar background regarding educational status and linguistic information. Participants also took a proficiency test to ensure they were advanced learners of English (see section 3.3.2 for the assessment of proficiency).

Data was collected from a total of 39 participants who volunteered to take part in the experiment. The data of 9 of them was excluded from

analysis due to insufficient proficiency (8 participants) and L1 other than BP (1 participant reported having moved to the United Stated at a very young age and considering English as his L1, not BP). Hence, the final number of participants computed was 30 (15 males). The mean age of the group was 28,87 years (SD=6,46).

According to personal information provided in the biographical questionnaire (see Section 3.3.1 and Appendix B), the mean age of learning English as L2 was 11,80 (SD=4,35). Participants' reported using English in class or at work and on certain occasions, such as playing games, watching movies/TV shows, listening to music and browsing the Internet. They also reported a minimum of 2 hours a day of L2 exposure to movies, TV Series, reading, games/Internet, and studying. Regarding level of proficiency, participants took the online level test Exam English (see subsection 3.3.2), which showed that their proficiency in English is at levels C1 (7 participants) and C2 (23 participants) of the Common European Framework of Reference for Languages (CEFR). They also provided self-evaluation concerning proficiency and they mostly reported being very good at the reading comprehension level. In relation to educational status, 4 participants were undergraduate students at UFSC (attending the Languages Program), 18 had already finished undergraduate school (with majors in Civil Engineering, Mechanical Engineering, and Modern Languages), and 8 reported having finished graduate programs in languages and communication (English Linguistics, English Literature, or Journalism). Regarding experience abroad, 12 participants reported having lived more than 2 months in an English-speaking country. Information related to participants' profile is summarized in Table 1.

Table 1 - Summary of information about participants who were computed in data analysis

Participant	**Age**	**Gender**	**Starting age of L2 learning**	**Level of English**	**Reported time lived in an English speaking country**	**Reported average of daily exposure to L2**
1	30	F	14	C1	6 months	2

2	26	M	6	C2	0	4
3	27	M	10	C2	0	8
5	30	F	17	C2	4 years	3
6	32	M	11	C2	0	5
7	27	M	16	C2	0	2
10	24	M	6	C2	0	9
12	30	F	3	C2	0	6
13	26	M	12	C2	0	6
14	23	M	10	C2	1 year	4
15	51	F	13	C1	1 year	2
16	18	F	12	C2	0	4
17	32	F	9	C2	0	6
18	25	F	16	C2	10 months	1
21	24	F	6	C2	0	10
22	25	F	12	C1	0	2
23	38	M	21	C2	0	5
25	23	F	19	C1	0	5
26	25	F	16	C2	5 months	10
27	30	M	12	C2	1 month	3
28	30	M	14	C2	0	4
30	21	M	8	C2	0	4
31	29	F	6	C2	1 year and 10 months	3
33	27	M	8	C2	3 months	4
34	25	M	15	C1	2 months	2
35	34	M	12	C1	8 months	2
36	41	F	14	C2	2 years	2
37	26	M	12	C2	0	5
38	35	F	7	C2	6 months	4
39	32	F	17	C1	3 months	3

***N*: 30**	**M= 28,87 (SD=6,46)**	**Number of males: 15**	**M= 11,8 (SD=4,35)**	**C1 level: 8; C2 level: 22**	**14 lived abroad (M=8,43; SD=7,09)**	**M=4,33 (SD=2,39)**

3.3. INSTRUMENTS

Three instruments for data collection were employed in the present experiment. These are a biographical and language background questionnaire, a proficiency test, and a behavioral self-paced reading syntactic priming task. The instruments will be described in the following subsections.

3.3.1. The biographical and language questionnaire

After signing the consent form, participants individually filled in a questionnaire with personal information and information about their language background. The print version of the questionnaire was taken from de Jesus (2012) and was adapted to be filled out on the Google Forms platform[2]. The participants answered questions about age, gender, contact information, educational background, and the learning and use of English (see Appendix B).

3.3.2. The proficiency test

Participants' proficiency in English was assessed by means of an online grammar and vocabulary level test available on the website Exam English[3]. This online test has been used in other studies carried out at the Laboratory of Language and Cognitive Processes (LabLing) at UFSC. The test consists of 15 multiple-choice questions. As soon as the test is completed, participants can see their level of proficiency according to the Common European Framework of Reference for Languages (CEFR) levels (A2 to C2). To be included in this study, participants had to achieve the advanced levels (C1 or C2).

[2] The questionnaire was stored and synchronized on Google Drive via the account of the Laboratório da Linguagem e Processos Cognitivos (LabLing).

[3] http://www.examenglish.com/leveltest/grammar_level_test.htm

3.3.3. The self-paced syntactic priming task

The behavioral experiment carried out in the present study aimed at assessing syntactic priming effects during a sentence processing task with BP and English sentences. In the task, passive voice sentences in BP primed English passive voice sentences in order to check whether a structure in one language would facilitate the comprehension of subsequent sentences with the same structure in the other. The experiment was designed and programmed as part of a family of studies about syntactic priming in the context of the research project carried out by Professor Mailce Borges Mota[4]. Therefore, the sentences in Portuguese that are part of the experiment carried out here were also used in two other studies (dos Santos, 2017; de Jesus, forthcoming).

The self-paced syntactic priming task was constructed with 320 sentences and consisted of 4 conditions (See 3.4 for a full description of the design of the task). In all conditions, the prime sentences were always in BP, whereas the target sentences were always in English. Condition 1 consisted of 20 pairs of prime-target sentences in the passive voice with equivalent translation for verbs, nouns and adjectives between prime and target sentence. Condition 2 consisted of 20 pairs of prime-target sentences in the passive voice with no translation equivalence between prime and target sentence. Condition 3 consisted of 20 pairs of prime-target sentences with equivalent translation for verbs, nouns and adjectives, but with different structures between prime and target: prime sentences were in the active voice, while target sentences were in the passive voice. Condition 4 had 20 pairs of prime-target sentences with active prime sentences and passive target sentences with no translation equivalence between prime and target.

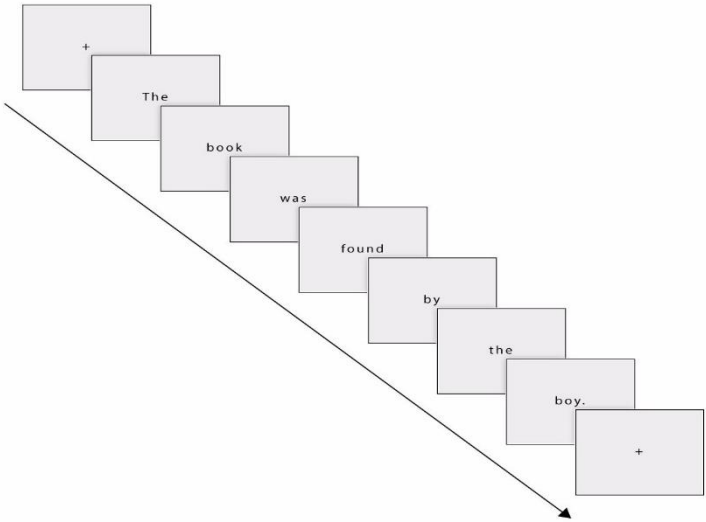
From the total of 320 experimental sentences that were part of the syntactic priming task, 80 were sentences in BP in the passive voice and served as priming sentences, 80 were sentences in English and served as target sentences, and 160 sentences (80 in BP) were fillers aimed at distracting participants' awareness to the experimental sentences. In addition, the task contained 15 yes/no comprehension questions presented after 25 sentences approximately in order to keep participants' attention to the task. The questions always appeared after a filler sentence.

[4] CNPq fellowship – Process 310729/2016-5

Participants had to press “S” for yes and “N” for no on the keyboard. The accuracy of response to comprehension questions was also measured.

The self-paced reading syntactic priming task was programmed in E-Prime 2.0 software (Psychology Software Tools, Pittsburgh, PA). The sentences of the experiment were presented word by word in the middle of the computer screen, in a white Arial font of size 18 on a black background in a DELL 23-inch widescreen monitor. After reading a word, participants had to press the space bar on the keyboard so that the next word could appear, thus providing a measure of reading time. During the interval between each sentence, a fixation cross was presented on the screen and participants had to press the space bar so that the first word of the next sentence could appear. An example of the presentation of a sentence is shown below in Figure 1:

Figure 1 - Presentation of an English target sentence.



The process of creation of the sentences for the experimental task included consulting 21 studies published in English that focused on syntactic priming in production and comprehension. This allowed for the selection of the most frequent verbs used in syntactic priming studies. The verbs selected (in English) and their equivalent translation into Portuguese were then checked for frequency in English and Brazilian Portuguese corpora. The nouns, adjectives and adverbs used in the sentences were also controlled for frequency. The criteria that defined the

selection of the corpora included free accessibility to the data base, information about word frequency, and the amount of verbs that were available for use in the data base. The creation of the sentences followed these procedures:

a) Sentences in Portuguese

Initially, a total of 640 sentences in Portuguese were created. These included 320 experimental sentences (prime) with transitive verbs, besides 320 control sentences (fillers) with intransitive verbs. Verbs (transitive and intransitive) and nouns (abstract and concrete) that ranged from 3 to 7 letters with frequency ranging from 1 to 9001 in a million were selected from the C-oral Corpus (Raso & Mello, 2012) and the *Corpus Brasileiro* (PUC-SP, 2016). These verbs and nouns were used in the creation of the sentences. From the experimental sentences in BP, 160 are in the passive voice and 160 are in the active voice. The 320 control sentences (fillers) are in the active voice.

All sentences in BP, in the active and passive voice, had from 6 to 7 words (e.g., *O carro foi vendido pelo nosso pai [The car was sold by our father]*). The word of interest, the main verb (*vendido*/sold), is always in the fourth position no matter the verbal voice or whether it is an experimental or a filler sentence. An adjective or a possessive adjective pronoun was inserted before the subject in the active voice and before the agent of passive in the passive voice. The fillers are control sentences that cannot stand out from the experimental group, thus, an addition of a complement with an adjective was also necessary to make the sentences similar in length. The following are examples of a sentence in the passive voice, a sentence in the active voice, and a filler sentence:

(1) *O carro foi vendido pelo nosso pai*. [The car was sold by our father.]

(2) *A mulher alta limpou a casa.* [The tall woman cleaned the house.]

(3) *A menina linda saiu da sala.* [The pretty girl left the room.]

b) Sentences in English

Based on the literature on cross-linguistic syntactic priming (e.g., Loebell & Bock, 2003; Fleischer, Pickering & McLean, 2012; Schoonbaert et al, 2007; Bernolet, Hartsuiker & Pickering, 2009; Hartsuiker et al., 2016; Weber & Indefrey, 2009), the BP prime sentences from conditions 1 and 3 – which had the translation factor – were

translated into English. For condition 1, 80 BP sentences were translated into English, and for condition 3, 80 BP active sentences were translated into English and put into passive voice. Conditions 2 and 4 did not have translation equivalence between prime and target, thus, 80 new English passive sentences were created for condition 2, and 80 English passive sentences were created for condition 4. The Corpus of Contemporary American English (COCA) was used to control for the length and frequency of the nouns and verbs in the creation of all new sentences in English for condition 2 and 4. The experimental sentences had transitive verbs and were 7-word length. Since the number of fillers had to be equal in both languages, the 320 BP filler sentences were then translated into English, also following the literature (e.g., Hartsuiker et al, 2016; Loebell and Bock, 2003; Weber & Indefrey, 2009).

3.3.3.1. The acceptability tests

After the phase of creation of the sentences in each language, all sentences went through an acceptability test performed by native speakers. The test aimed to check for the naturalness of the stimuli. The sentences were arranged in 16 lists in Google Docs, 12 lists for the sentences in BP and 4 lists for the sentences in English. A mean of 9.5 (range 9-12) BP native speakers evaluated the BP sentence lists, and a mean of 11 (range 10-12) native speakers of English evaluated the English sentence lists. There were 4 lists with 40 BP sentences each, 8 lists with 80 BP sentences, and 4 lists with 40 English sentences each list. The sentences had to be assessed on a 5-point Likert scale (adapted from Santos, 2015) (see Table 2) and native speakers were required to determine how natural each sentence sounded in their mother tongue. They performed the acceptability test online by accessing a link in Google Docs. After this evaluation, the mean for each sentence was then computed. A mean value below 2.9 indicated that the sentence did not seem natural enough for native speakers. Therefore, sentences with a mean of 2.9 or below were edited and reviewed for a final inspection.

Table 2 - The 5-point scale used in the acceptability tests.

1 = Completely inadequate (No one would say that)
2 = Bad/Weird (Acceptable, but it could be better)

3 = Good (But it could be more natural)
4 = Very good (Natural)
5 = Great (Naturally well-constructed)

3.4. RESEARCH DESIGN

The design for the syntactic priming task follows Schoonbaert et al.'s (2007) cross-linguistic L1-L2 study and has a 2x2 sentence design for prime type (passive vs. active) and verb type (translation vs. unrelated), considering that target sentences are always English passives. Therefore, the present experiment had 4 conditions, as described in Table 3.

Table 3 - Behavioral experimental conditions.

Condition 1	BP passive prime sentences paired with English passive target sentences, with translation from prime to target
Condition 2	BP passive prime sentences paired with English passive target sentences with no translation equivalence between prime and target
Condition 3	BP active prime sentences paired with English passive target sentences with translation from prime to target
Condition 4	BP active prime sentences paired with English passive target sentences with no translation equivalence between prime and target

Each condition consisted of 20 trials. A trial is a combination of a BP prime and an English target sentence, followed by 1 to 3 fillers, as seen in the literature (e.g., Weber & Indefrey, 2009). As a result, trials vary from 3 to 6 sentences each. Table 4 presents examples of a trial in each condition.

Table 4 - Examples of trials for each condition.

	Condition 1
Prime	O filme foi visto pela nossa avó. [The film was watched by our grandmother.]
Target	The movie was watched by our grandmother.
Filler	O casal amoroso casou na igreja. [The loving couple got married in the church.]
Filler	The fourth class watched the play.
Filler	The happy woman walked at night.
	Condition 2
Prime	A menina foi tratada pelo doutor famoso. [The girl was treated by the famous doctor.]
Target	The man was arrested by the police.
Filler	A avó grossa gritou da janela. [The mean grandmother yelled from the window.]
	Condition 3
Prime	A menina linda abriu a janela. [The beautiful girl opened the window.]
Target	The window was opened by the girl.
Filler	O bicho estranho caiu do carro. [The weird bug fell from the car.]
	Condition 4
Prime	O menino bravo fechou a porta. [The angry boy closed the door.]
Target	The man was caught by the police.
Filler	O menino doente foi ao teatro. [The sick boy went to the theater.]
Filler	The poor family dined at the table.

The 320 trials were counterbalanced in four different lists in the Latin square[5], as presented in Table 5.

Table 5 - Disposal of conditions in each version of the experiment randomized by Latin square.

	Conditions			
Version 1	1	2	3	4
Version 2	2	3	4	1
Version 3	3	4	1	2
Version 4	4	1	2	3

Each list of the experiment had 20 different trials of each condition plus 160 fillers, thus each participant saw all four conditions once, yet they were presented with a different list of stimulus in a different order each time. The presentation of the lists to the participants followed the order of data collection: participant 1 saw the first list, participant 2 saw the second list, participant 3 saw the third list, participant 4 saw the fourth list, and from the 5th participant on, the presentation of the lists started again following the order 1, 2, 3 and 4. Since the exclusion of participants (previously mentioned in Section 3.2) occurred after data collection, the final presentation was not performed equally. As shown in Table 6, list number 4 was less performed.

Table 6 - Number of times the lists were performed.

Version 1	8
Version 2	10
Version 3	8
Version 4	4

In addition, before the experimental task, there was a practicing session with one pair of prime-target sentence from each condition ending with one filler sentence and one comprehension question. The trials for

[5] Latin square is an *n x n* array filled with *n* different values, which appear only once in each row and column (Mann, 1942).

the practicing session were randomized across conditions, thus they did not repeat either.

3.5. PROCEDURES

Data collection occurred in the experimental cabin at LabLing-UFSC. After signing the consent form, filling in the questionnaire and taking the online proficiency level test, participants sat on a chair in front of the computer to take the experiment. Participants performed both the proficiency level test and the self-paced syntactic priming task on a Dell XPS computer with a Dell 23-inch widescreen monitor. The whole session lasted from 30 up to 45min, but the sentence comprehension task took around 30min for each participant. Following the experimental protocol, I read the instruction screen with the participants and stayed in the cabin while they took the practicing session to make sure they understood the experiment and to answer questions they had. After that, participants were left alone to take the experiment and when they finished, the data was automatically saved, and participants could leave the room.

The next section will provide a report of the pilot study.

3.6. PILOT STUDY

The data collection of the pilot study occurred during the months of December of 2016 and March of 2017 at LabLing-UFSC. The objective of the pilot study was to test the instruments and procedures, and, if necessary, review the design and programming of the experiment. Sixteen learners of English as L2 participated in this process, but only fifteen sessions could be computed, since there was a problem with version 2 of the experimental syntactic priming task during the second participant session, and the data collection from this participant was lost. The remaining participants were all from the Graduate Program in English at UFSC and all had advanced proficiency in English. During the pilot study, participants signed the consent form and filled in printed versions of the biographical and language questionnaire.

During the pilot study, I followed the experiment through a mirrored screen outside the experimental cabin and, based on this procedure and on information provided by the participants, spelling mistakes were reviewed and problems with E-prime programming were repaired. No other changes were necessary after the pilot study, the instruments and procedures were then repaired and ready for the experimental data collection.

The next chapter will provide information about the results as well as the discussion of the data obtained from the experimental cross-linguistic syntactic priming task.

4. RESULTS AND DISCUSSION

This chapter aims at presenting the results of the present study by discussing whether there are effects of cross-linguistic syntactic priming from L1 BP on L2 English and whether lexical repetition exerts influence in syntactic priming. The study was carried out with an experimental group of 30 Brazilian speakers of English as L2. The chapter is divided in 4 sections. Section 4.1 presents the pre-processing procedures conducted before analyses. Section 4.2 describes the analyses of the behavioral data. Finally, section 4.3 presents the discussion regarding the behavioral results of this study.

4.1. DATA PRE-PROCESSING

This section describes all the steps and procedures which the data went through after the finalization of data collection. It was important to clean the material and remove possible outliers regarding response time, as well as to determine the mean number of correct responses to the comprehension questions, among other steps that will be described as they appear along the process.

Before starting the analyses, participants' responses to the comprehension questions of the syntactic priming task were checked to verify whether they had displayed equal performance in answering correctly the 15 comprehension questions. The questions aimed at controlling participants' attention during the experiment, so any outliers would be excluded, if necessary. The mean value of correct answers was 14 with 2 standard deviation away from the mean corrected answers (M = 14, SD = 2). After this, response time values of BP articles (e.g., *o*/*a*) below 50ms and impossible values (under 150ms) were removed across sentences and conditions. The next procedure was the calculation of the mean reading time (RT) per word of prime and target sentences across conditions. In this process, means and standard deviations for each word of the sentence were calculated with a Mean±2SD formula, and outliers were then removed. This data preprocessing was conducted for each experimental condition of the study. Table 7 presents, in percentage, how much of the data was discarded.

Table 7 - Percentage of discarded data before data analysis.

Condition 1	3,7%
Condition 2	4%

Condition 3	4,2%
Condition 4	3,8%

The next section will provide information regarding each condition and their results after statistical analyses.

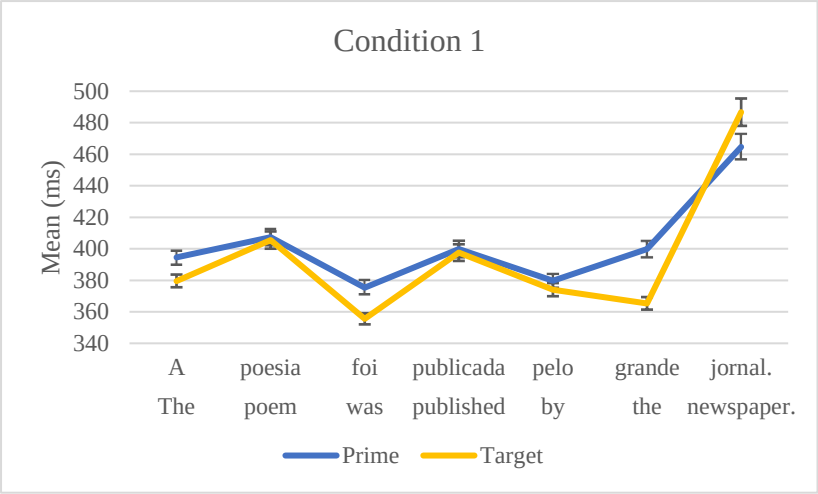
4.2. ANALYSES OF THE BEHAVIORAL DATA

The experiment aimed at assessing cross-linguistic syntactic priming. The third word (the auxiliary), the fourth word (the main verb) and the fifth word (the by-preposition) were the region of interest when comparing prime and target sentences within and across conditions. This section will present the four experimental conditions of the study: they were all cross-linguistic conditions with BP sentences priming English sentences, but as previously described in section 3.4, two conditions shared structures with translation equivalence of verbs and nouns between prime and target.

4.2.1. Condition 1: shared structure with translation equivalents

This subsection presents the results for the experimental design of Condition 1 of this study. In Condition 1, BP passive sentences primed English passive sentences. This condition shared a passive structure with translation equivalents for verbs and nouns between prime and target sentences (e.g., Prime: *A poesia foi publicada pelo grande jornal*; Target: The poem was published by the newspaper). Figure 2 shows the means of RT, in milliseconds, for each word of a sentence in Condition 1.

Figure 2 - Mean reading times for Condition 1: shared structure and same translation for verbs and nouns. Error bars denote standard errors around the mean. An example of a prime and target sentence are presented in the graph.

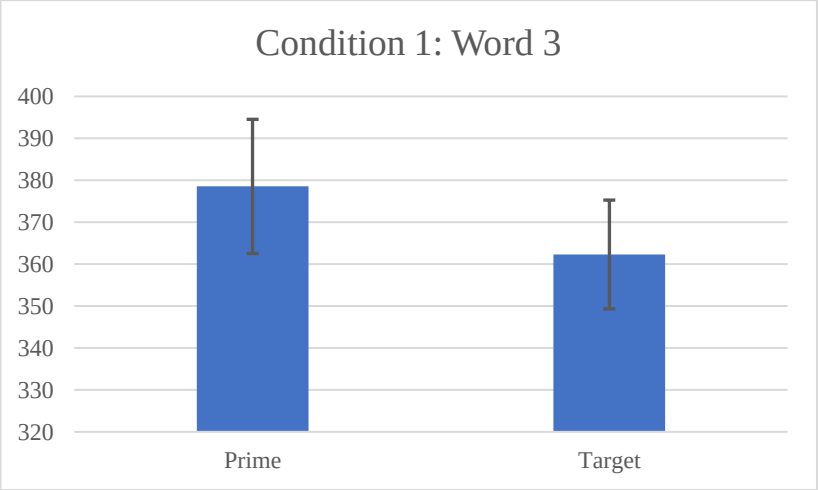


The means shown in Figure 2, related to the region of interest of the passive voice structure – the auxiliary verb, the main verb, and the by-preposition – (words 3, 4 and 5, respectively), indicate a reduction in the RTs of the third word, which in this condition corresponds to the auxiliary verb *to be* in the 3rd person past tense (*foi*/was). However, as represented in Figure 2, the main verb in the past participle – word 4 – did not show a significant priming effect, as expected, since there is no visible reduction in RTs, nor in word 5 (by-preposition). While in words 1 and 6 there is a reduction in RTs, the target word 6 does not have a direct relation with the prime word 6, despite the reduction of RT. In prime sentences word 6 may represent a noun, adjective or possessive adjective, and in target sentences it can refer to the article or a possessive adjective as well, thus, this reduction is not directly related to lexical or grammatical influence of one word over the other.

A paired-samples t-test was conducted to compare the means of prime and target RT values of each word from the critical region (words 3, 4 and 5), and thus to determine whether the difference in the time of processing between prime and target was statistically significant. For word 3, as shown in Figure 3, the RT significantly decreases from prime (M=378, SD=87) to target (M=362, SD=71), $t(29)=3.207$, p=0.003 with a medium-sized effect $r=0.51$, thus indicating that, after being primed by

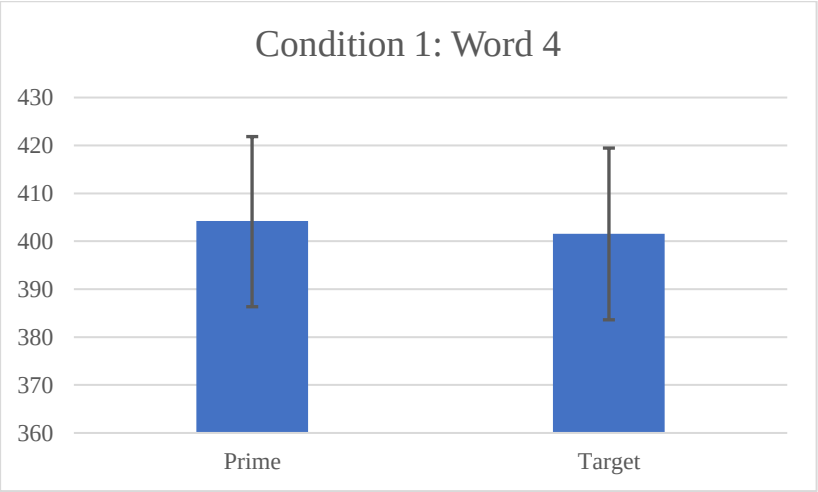
the auxiliary verb in BP, participants processed the auxiliary verb in English more efficiently and effortlessly.

Figure 3 - Mean reading times for word 3 (auxiliary verb) of Condition 1. Error bars denote standard errors around the mean.



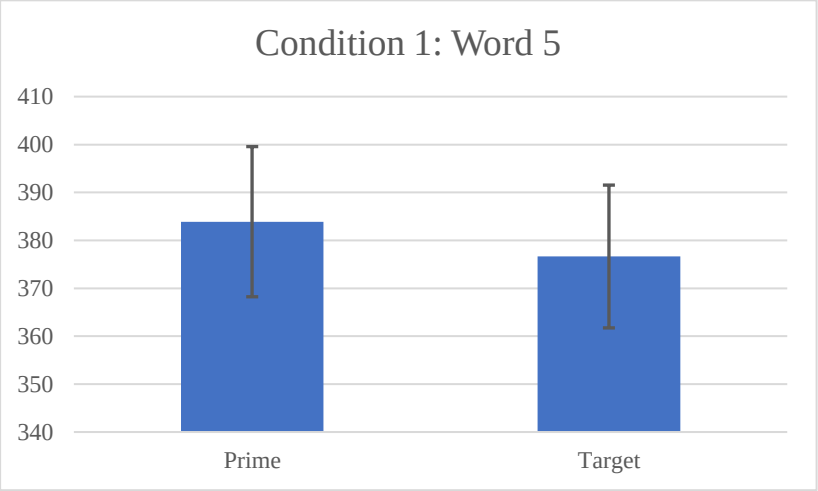
As shown in Figure 4, the main verb of the passive structure, however, does not show a significant RT decrease from prime (M=404, SD=96) to target (M=402, SD=98), $t(29)=0.617$, $p=0.542$ with a small-sized effect $r=0.11$. Contrary to what was expected, these results indicate that the difference of RT of word 4 - the verb in the past participle - between prime and target is not statistically significant.

Figure 4 - Mean reading times for word 4 (main verb) of Condition 1. Error bars denote standard errors around the mean.



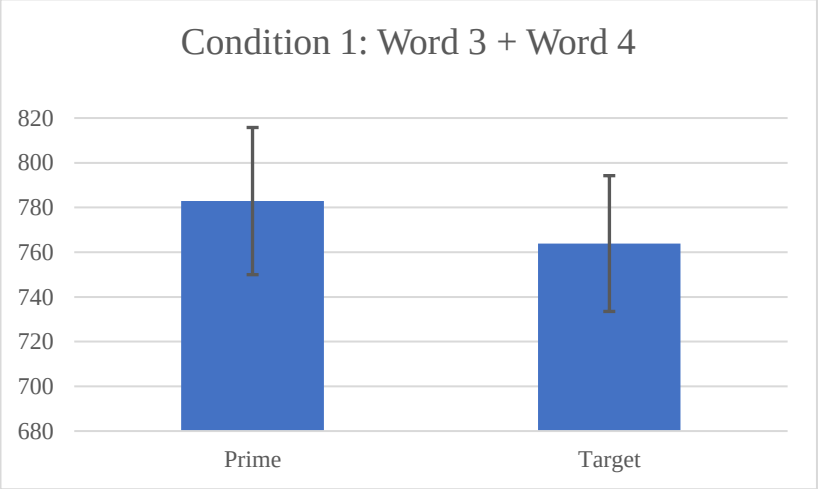
Last, the means of RTs for word 5 (by-preposition) were compared between a prime and a target. As presented in Figure 5, there is a slight reduction in time of processing from prime (M=383, SD=85) to target (M=376, SD=81), $t(29)=1.715$, $p=0.097$, with a small-sized effect $r=0.30$, so the by-preposition in BP (*pelo/pela*) does not significantly influence the processing of the same preposition in English.

Figure 5 - Mean reading times for word 5 (by-preposition) of Condition 1. Error bars denote standard errors around the mean.



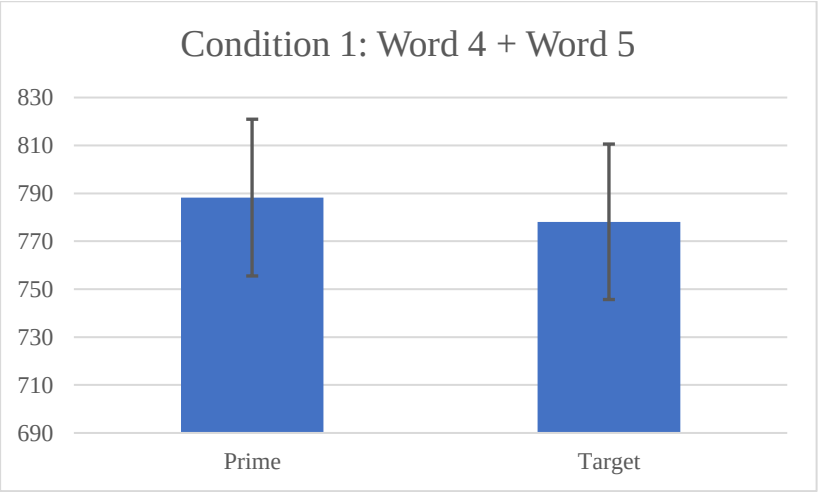
After examining the mean of all the words separately, the critical region was analyzed with a paired-samples t-test. The words were grouped in three means: word 3 and word 4, word 4 and word 5, and word 3, 4 and 5 altogether. As seen in Figure 6, there is a small, yet significant, reduction in time of processing of words 3 and 4 from prime (M=784, SD=180) to target (M=764, SD= 166), $t(29)=2,610$, p=0.014, with a small-sized effect $r=0.44$.

Figure 6 - The sum for the mean reading times for word 3 and 4 (auxiliary verb and main verb) of Condition 1. Error bars denote standard errors around the mean.



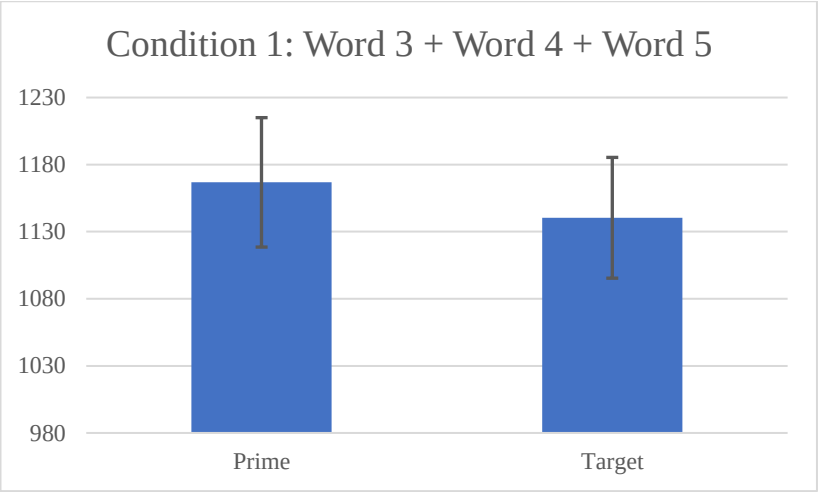
Next, the means of word 4 and 5 RTs were grouped and compared within Condition 1. As seen in Figure 7, there is a small reduction in RT from prime (M=788, SD=179) to target (M=778, SD=178), $t(29)=1,410$, p=0.169, thus demonstrating that, in the target sentences, participants did not take less time to process this critical region.

Figure 7 - The sum for the mean reading times for word 4 and 5 (main verb and by-preposition) of Condition 1. Error bars denote standard errors around the mean.



Last, the whole critical region of the passive structure was analyzed, and RTs were compared. As shown in Figure 8, there is a reduction of the means of RT from prime (M=1167, SD=264) to target (M=1140, SD=247), $t(29)=2.531$, $p=0.017$ with a medium-sized effect $r=0.43$. These results can be interpreted as significant ($p < .05$) and substantial ($r=0.43$), thus showing that the processing of the critical region of passive voice in BP facilitated the processing of the same critical region in participants' L2 (English).

Figure 8 - The sum for the mean reading times for word 3, 4 and 5 (auxiliary verb, main verb and by-preposition) of Condition 1. Error bars denote standard errors around the mean.

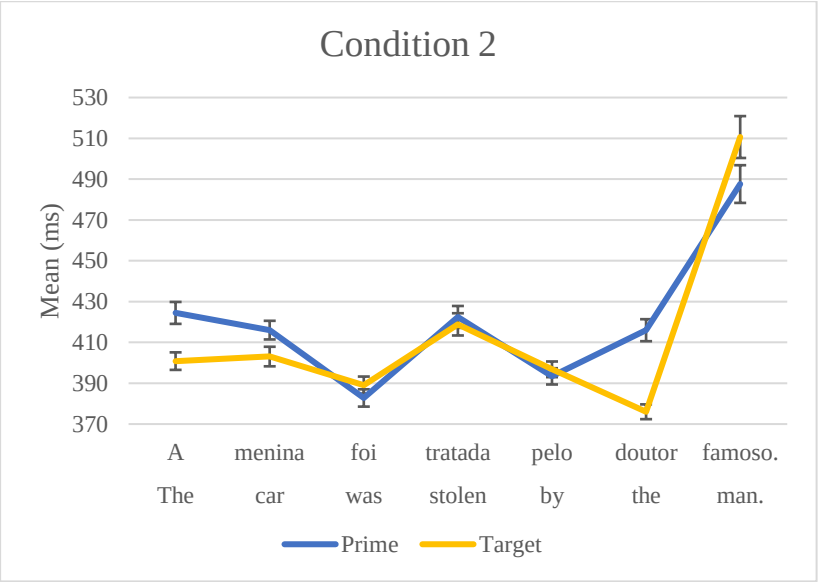


The discussion of these results will be presented in section 4.3. The next section will provide information regarding Condition 2 and its results.

4.2.2. Condition 2: shared structure with different translation

This subsection presents the findings from Condition 2 of this study. This condition maintains the same structure for both BP prime and English target sentences, but with different translation for verbs and nouns (e.g., Prime: *A senhora foi examinada pelo médico novo* [The lady was examined by the new doctor]); Prime: The car was stolen by the man). Figure 9 presents the means for the RT from this Condition.

Figure 9 - Mean reading times for Condition 2: shared structure and different translation for verbs and nouns. Error bars denote standard errors around the mean.



In this condition, as shown in Figure 9, we observe a decrease in RT for words 1, 2 and 6. However, word 6 does not represent the same word for prime and target, whether in terms of grammatical functions or translation equivalents, since for prime sentences, word 6 indicates a noun, adjective or possessive adjective, and for target sentences, it may refer to articles or possessive adjectives.

A paired-samples t-test was conducted within Condition 2 to compare the mean RTs of prime and target for the words and region of interest (words 3, 4 and 5). A reduction of RT of word 3 was expected when comparing sentences, since both prime and target sentences have the auxiliary verb *to be* in the third position. However, as shown in Figure 10, there was an increase of RT from prime (M=386, SD=77) to target (M=392, SD=75) regarding the auxiliary verb ($t(29)=-1.387$, $p=0.176$). By looking at Figure 9 again, it is visible a reduction for word 1 and 2, but when it comes to the processing of word 3, participants took more time to process it in the target sentences. Even though in Condition 2 nouns and verbs of prime passive voice sentences are not equivalent to nouns and verbs of target passive voice sentences, the auxiliary verbs are of course equivalent (*foi*/was).

Figure 10 -Mean reading times for word 3 (auxiliary verb) of Condition 2. Error bars denote standard errors around the mean.

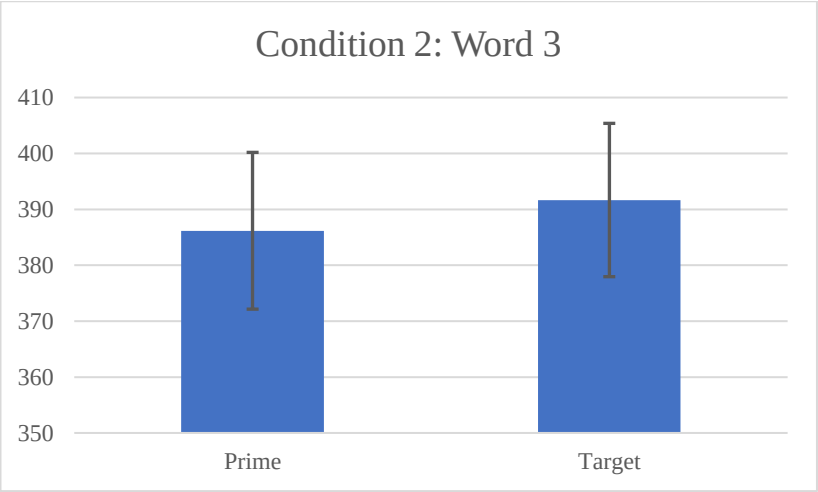


Figure 11, next, presents a comparison of the mean RTs for word 4 (main verb of the passive structure) in prime and target sentences of Condition 2. When pairing the means for prime (M=429, SD=100) and target (M=423, SD=98), a slight reduction of the mean for word 4 is observed. However, the results of the t-test indicate that the reduction is not statistically significant ($t(29)= 0.991$, $p= 0.330$). In Condition 2, the main verbs in prime and target sentences are not equivalent in meaning.

Figure 11 - Mean reading times for word 4 (main verb) of Condition 2. Error bars denote standard errors around the mean.

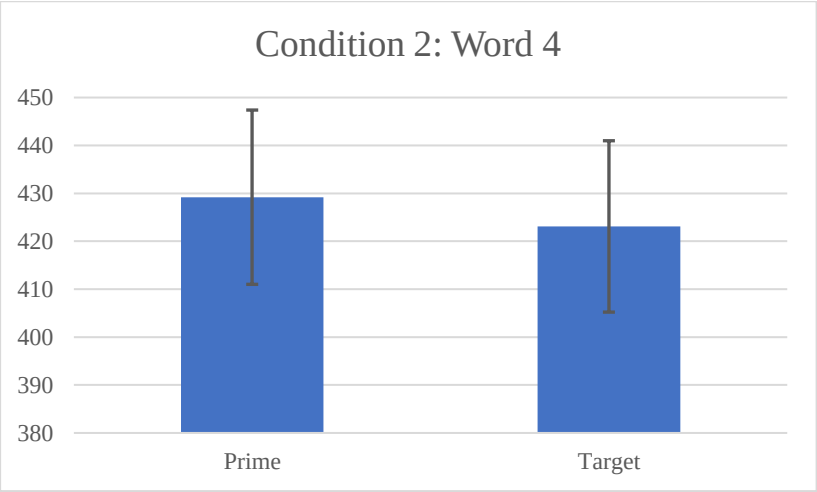
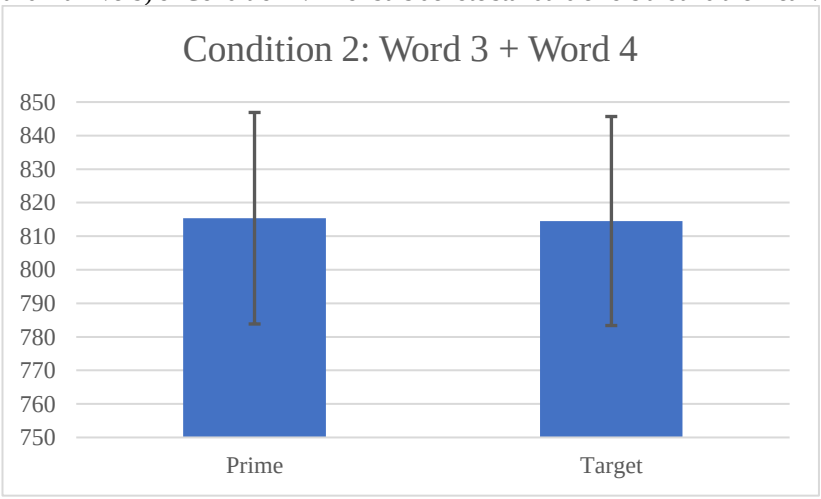


Figure 12 shows that, as occurred with word 3, there was a small increase in the means of RT between prime (M=395, SD=14) and target (M=398, SD=12) for word 5 (by-preposition). The results of the paired-samples t-test are not significant either, since it was expected to have a decrease in RT, and not the opposite ($t(29)= -0.571$, $p= 0.572$).

Figure 12 - Mean reading times for word 5 of Condition 2. Error bars denote standard errors around the mean.

Next, the critical region (words 3, 4 and 5) was analyzed within Condition 2. Figure 13 shows the prime and target mean RT (M=815, SD=173; and M=815, SD=171, respectively) for words 3 and 4 (auxiliary and main verb).

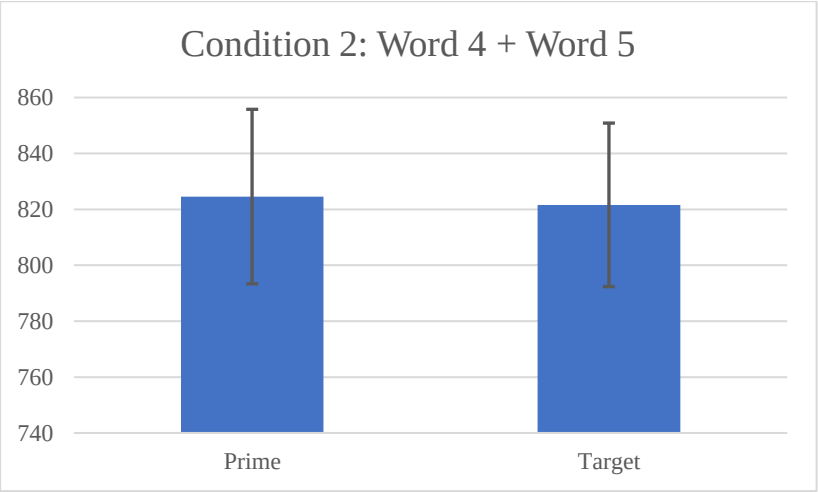
Figure 13 - The sum for the mean reading times for words 3 and 4 (auxiliary verb and main verb) of Condition 2. Error bars denote standard errors around the mean.



As can be seen in Figure 13, the means are the same. The results for the paired-samples t-test show that there is no statistically significant priming effect for this region ($t(29)= 0.108$, $p= 0.915$).

Figure 14 displays the means of RTs for word 4 and 5 grouped together.

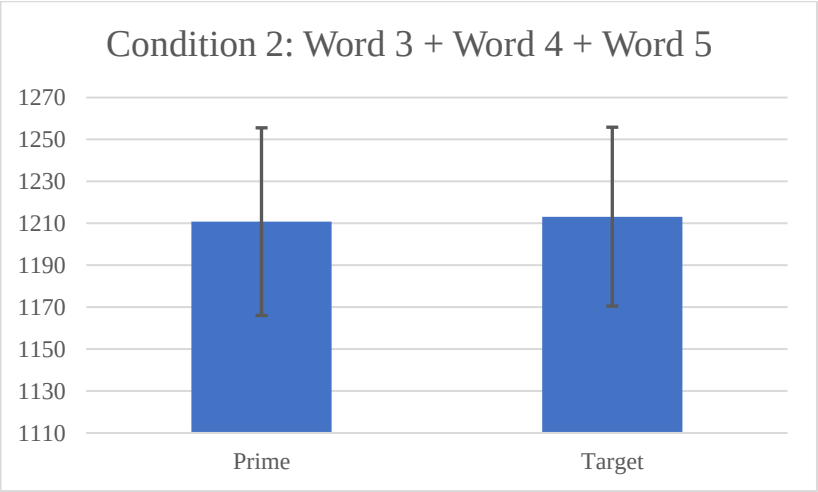
Figure 14 - The sum for the mean reading times for words 4 and 5 (main verb and by-preposition) of Condition 2. Error bars denote standard errors around the mean.



As shown in Figure 14, the difference between mean RTs for prime and target regions (words 4 and 5) is minimal (M=825, SD=171 and M=822, SD=160, respectively), and no statistically significant priming effect was found from prime to target, (t(29)= 0.316, p= 0.754).

The last statistical analysis for this Condition concerned the whole critical region of the passive voice structure. As can be seen in Figure 15, the sum of the means of words 3, 4 and 5 was compared between prime (M=1211, SD=245) and target (M=1213, SD=234).

Figure 15 - The sum for the mean reading times for words 3, 4 and 5 of Condition 2. Error bars denote standard errors around the mean.



The results of paired-samples t-test show no significant priming effect ($t(29)= -0.219$, $p= 0.828$) for this region. In other words, there is no significant difference in the processing of the passive voice structure between L1 BP to L2 English. Overall, the results found for Condition 2 are in contrast with those found for Condition 1, in which there was lexical repetition in the critical region and shared structure between prime and target. Taken together, the results so far seem to indicate that syntactic priming effects from L1 to L2 are related to shared lexical items.

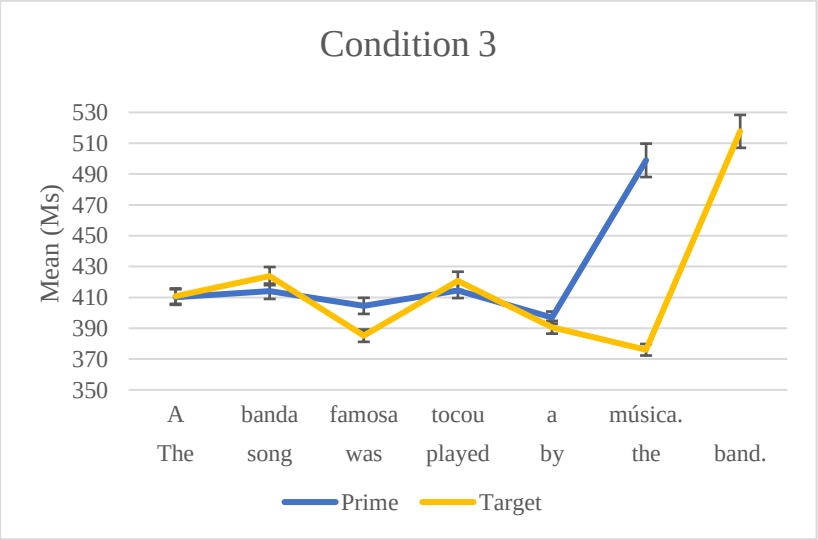
The discussion related to the findings of this condition will be presented in Section 4.3. The next subsection presents the results for Condition 3, which had different syntactic structures but equivalent translation between prime and target sentences.

4.2.3. Condition 3: different structure with translation equivalents

This subsection shows the results for Condition 3, which had different structures for prime and target sentences (active vs. passive sentences) with translation equivalents for verbs and nouns in BP and English. The target sentence is the passive voice of the prime active sentence, the active verb is aligned with the its past participle form in the target sentence (e.g., Prime: *A banda famosa tocou a música* [The famous band played the song]; Target: The song was played by the band).

Figure 16 presents the mean values of RT for this condition.

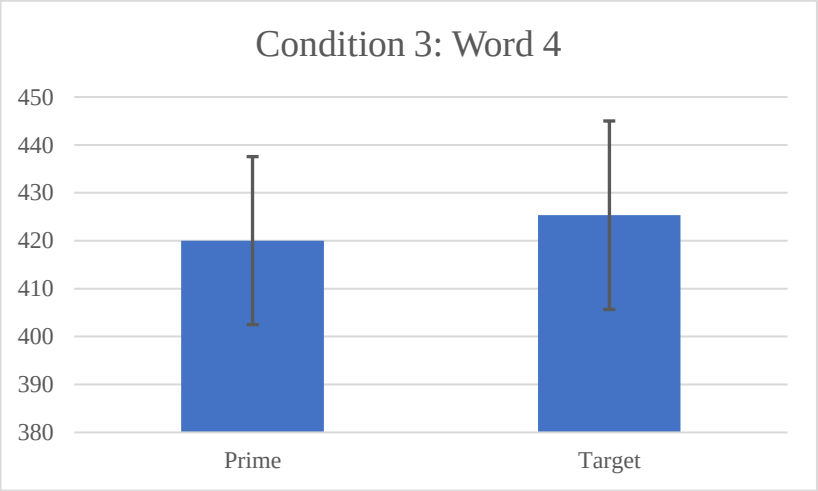
Figure 16 - Mean reading times for Condition 3: different structure and translation equivalents for verbs and nouns. Error bars denote standard errors around the mean.



There is a decrease in reading time for word 3. However, prime sentences word 3 has a grammatical category that is different from that of word 3 in target sentences. As prime, word 3 refers to a noun or an adjective in the active voice, whereas as target, word 3 refers to the auxiliary verb *to be* for the passive structure. Thus, the reduction in the time of processing of word 3 in target sentence does not seem to be directly related to the grammatical aspect of word 3 in prime. The same occurs for word 6, which relates to a noun in prime sentence, and it can be the article *the* or a possessive adjective in target sentence, thus indicating that the reduction in RT in target sentence is more likely to be related to word length than grammatical aspects.

A paired-sample t-test was conducted to compare the means for the fourth word in this condition: the main verb of the active and passive sentences. In prime sentences, word 4 is an active verb in the past tense, while in target sentence, the same verb is in the past participle. As seen in Figure 17, there is a small increase in the means from prime (M=420, SD=96) to target (M=425, SD=108), $t(29)= -0.894$, $p= 0.379$. Thus, the result for this condition is not statistically significant and it indicates that there was not a priming effect from active to passive voice, even though the main verb has shared meaning for both verbal voices.

Figure 17 - Mean reading times for word 4 (main verb) of Condition 3. Error bars denote standard errors around the mean.

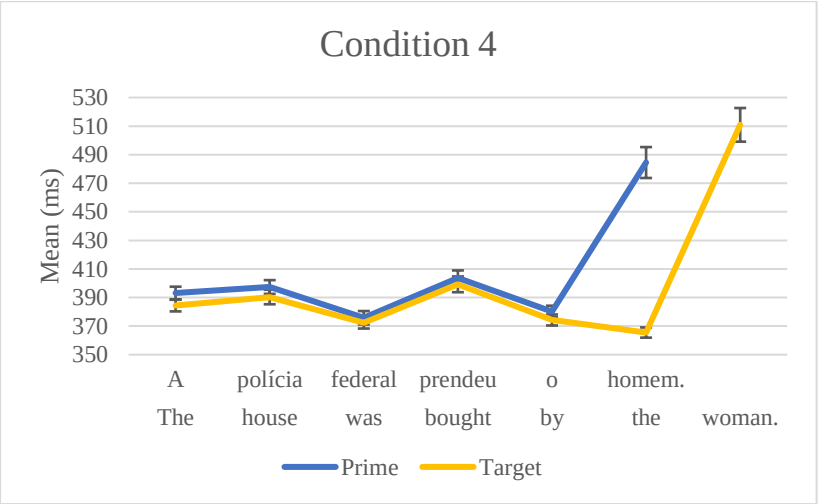


The discussion related to this condition will be presented in section 4.3. In the next section, results for the fourth and last experimental condition will be reported.

4.2.4. Condition 4: different structure with different translation

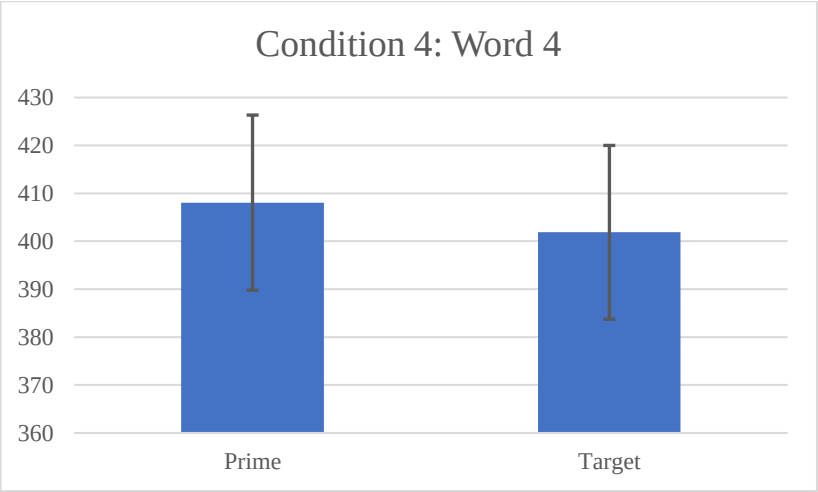
This subsection presents the results for Condition 4 of this study. This condition controls for the structural and translation aspects. The sentences have different structures and different verbs and nouns between prime and target, BP active sentences primed English passive sentences, thus active sentences are shorter, but the main verb remains in the fourth position (e.g., Prime: *A polícia federal prendeu o homem* [The federal police arrested the man]; Target: The house was bought by the woman). The RT mean values for Condition 4 are presented in Figure 18.

Figure 18 - Mean reading times for Condition 4: different structure and different translation for verbs and nouns. Error bars denote standard errors around the mean.



The paired-sample t-test compared the means for the main verb of prime and target sentence, which is in the fourth position in order or presentation. There is a small decrease from prime (M=408, SD=100) to target (M=402, SD=99) in RT ($t(29)= 0.969$, $p= 0.340$). Since this condition has different structures and no lexical repetition between prime and target, it was already expected to not find a significant priming effect, as compared to the other experimental conditions.

Figure 19 - Mean reading times for word 4 (main verb) of Condition 4. Error bars denote standard errors around the mean.



The discussion for these results will be presented in the next section.

4.3. DISCUSSION OF THE RESULTS

In this section I will discuss the findings of the cross-linguistic syntactic priming task that were previously described in section 4.2. The two research questions of this study (see Chapter 3) address whether there are syntactic priming effects of L1-PB on L2-English, and, supposing there are, whether they are dependable on lexical repetition between prime and target sentences. This section will provide answers to these questions by readdressing and discussing the hypotheses that were pursued within the experimental design of the study.

As described in section 3.4, there were four experimental conditions: two controlled for the structural aspect and the other two controlled for the translation aspect. In all conditions, the region of interest corresponded to the passive voice structure, which included the auxiliary verb, the main verb, and the by-preposition (words 3, 4 and 5, respectively). Overall, the effects of syntactic priming in comprehension were found exclusively in Condition 1, in which prime and target sentences shared the same syntactic structure and the same translation equivalents.

In Condition 1, there was a significant reduction in RT for the auxiliary verb of the prime to the target sentence (*foi*/was), although this reduction did not occur for the main verb and the by-preposition

separately. Discussing the elements of the region of interest individually, it is still possible to state that effects of syntactic priming occurred for word 3 (the auxiliary verb). As described in section 2.2 of the Theoretical Framework Chapter, the present study focused on verbal be-passives, which are formed by the auxiliary verb *be*, the past participle of the main verb, and the by-phrase. Thus, even though word 3 represents only one component of the verbal passive, it is a strong element for be-passives.

The auxiliary-be and the main verb were combined and a weak priming effect for words 3 and 4 occurred, but when comparing the RT means of prime and target for the main verb and the by-preposition (words 4 and 5), the effect does not appear. However, the analysis of the whole region of interest regarding be-passives showed a substantial syntactic priming effect for the repeated structure with translation equivalents between prime and target. The results of Condition 1 are in line with those of Weber and Indefrey's (2009) study, in which the comparison of reading time for the apparent syntactic structure of passive voice (the third word onwards) in German and English showed that English passives were read faster after being primed by German passives that were translation equivalents. Thus, as in the case of the syntactic priming effect for BP-English of this study, this reduction in RT provides evidence for an L1 and L2 syntactic processing interaction (Weber & Indefrey, 2009).

The results of Condition 1 showed that not only did the auxiliary verb reveal a priming effect, but the region of interest representing the whole passive voice structure also showed significant priming effects. Thus, the results for Condition 1 can be interpreted as support for hypothesis 1 (see Section 3.1 for clarification), which predicted that there would be a significant syntactic priming effect of L1 BP on the processing of L2 English sentences in the passive voice. Since these findings are related to Condition 1, where the repeated structure and translation aspects were both present, the results can also be taken as evidence for hypotheses 2 and 3 of this study, which predicted, respectively, that (2) there would be a significant syntactic priming effect of L1 Portuguese on L2 English processing of passive voice during comprehension in the repeated structure condition, and (3) in the translation equivalent condition. However, these two hypotheses are taken as confirmed only when the experimental design had both translation equivalents and shared structures, otherwise, as happened in Condition 2, syntactic priming effect was not found because the sentences only shared structures.

Although there was a reduction in RT for the auxiliary verb (*foi*/was) in Condition 1, this reduction is not significant in Condition 2, in which the auxiliary verb still appears in the same word order for prime

and target. Instead, participants took more time to read word 3 of the target sentence than the prime sentence in this Condition. The analysis of the regions of interest in Condition 2 showed that there was no priming effect. Indeed, not having the same content words between sentences did play a significant role for the trials that shared the same syntactic structure in the experiment. As pointed by Branigan et al. (2005), priming in comprehension without verb repetition may be weaker and difficult to detect, especially if compared to priming in production, in which priming with verb repetition is twice as strong as priming without verb repetition. Thus, one can contend that the likelihood that syntactic priming effects will occur in comprehension relies on lexical aspects (e.g., Arai et al., 2007; Weber & Indefrey, 2009).

The hypotheses of this study were supported by the results of the experimental design of Condition 1 only. Although in Condition 2 prime and target sentences had the same syntactic structure, the words between prime and target were not translation equivalents. Condition 3 did not show a priming effect. In this Condition, there was no repetition of syntactic structure between prime and target, but articles, nouns, adjectives and main verbs were translation equivalents. Therefore, translation equivalents from L1 to L2 were not relevant for conditions in which the syntactic structure was different between prime and target. Active sentences could not prime passive sentences that carry translation equivalents of each other. Condition 4 did not show a priming effect either. This condition had different syntactic structures between prime and target and no translation equivalents for prime and target sentences, being the less likely condition to exhibit a priming effect, thus serving as a control condition for the structural and translation factors. Taken together, the results of the experiment show that syntactic priming effects from L1 to L2, during comprehension, are more likely to occur when prime and target sentences share both the same syntactic structure and the same or equivalent lexical items.

There are more models to explain syntactic integration in production (see Hartsuiker et al., 2004; Maier, Pickering, & Hartsuiker, 2017), and syntactic priming overall is seen as a multifaceted effect (Ferreira & Bock, 2006). In production, the effects of syntactic priming reflect the residual activation model of the combinatorial node that both languages share (Hartsuiker et al, 2004; Hartsuiker & Pickering, 2008). Another explanation for priming in production is the alignment of representations during dialogues (Ferreira & Bock, 2006). This aspect of communication is lost in experimental reading settings, being too static for the reader to choose the syntactic configuration to use next.

During comprehension, the individual words and their order in a sentence convey their syntactic features making it possible for the reader to comprehend the sentence (Tooley & Traxler, 2010). But as shown in this study, this facilitation in comprehension between languages was possible only when the words were shared. The data from this study can be explained by the model of bilingual lexicon-syntactic integration under the shared-syntax view (Hartsuiker et al., 2004), presented in Chapter 2, in that when the two languages have similar syntactic structures, the combinatorial nodes that represent the structure will also be shared. The combinatorial nodes of the shared lemma were activated when prime and target shared translations equivalents, providing activation of their syntactic features as well. However, the model of bilingual lexicon-syntactic integration could not explain the results for Condition 2, considering that in comprehension, it seems that the syntactic aspect was not sufficient to stand out by itself and provide integration between language systems.

Nevertheless, it is still worth stating that the results of this study show integration between BP-English systems. The lexical boost found in Condition 1 can be explained in terms of the unification of the lexical entries with their syntactic information (Branigan & Pickering, 2016), showing that, as argued by Pickering and Ferreira (2008), syntactic knowledge is not fully abstract, since lexical information can boost priming. However, if only shared lexicon would be sufficient to provoke priming during sentence comprehension, the condition that had only shared translations (Condition 3) would show priming between the main verb (word 4). As Hartsuiker and Pickering (2008) suggested, languages share syntactic representations mostly if they share the same word order, being the case of BP-English. Overall, these findings provide us with insights for syntactic processing with this bilingual population, as well as evidence for the shared-syntax account. In terms of the neurocognitive models presented in Chapter 2 – the Declarative/Procedural Model (Ullman, 2001, 2013) and the MUC Model (Hagoort, 2003, 2005, 2013, 2016, 2017) –, it is possible to speculate that the results are in line with the proposals of the MUC Model, since it postulates that syntactic processing is lexically driven. Although, it is worth stating that the MUC Model is a neurocognitive model of L1 processing and the results of this study are behavioral.

The next chapter will present the final remarks of this research, summarizing the findings and offering further suggestions for future research.

5. FINAL REMARKS

This chapter presents the main findings of the present study, whose main objective was to investigate syntactic processing in BP-English bilinguals under the psycholinguistic paradigm of syntactic priming. A cross-linguistic self-paced reading experiment was conducted to investigate whether there are any effects of syntactic priming of BP-L1 on the processing of English-L2 with a population of 30 adult late-bilinguals, and, if so, to verify the influence of lexical repetition on the effects of syntactic priming.

This chapter is divided into two sections: section 5.1 presents the main results of the experiment and section 5.2 explores implications for further research.

5.1. CONCLUSIONS

Research on the representation of syntactic representation in bilinguals has shown that L1 and L2 are related in one's mind, and the question extends to the extent of the level of these shared representations. Do these two languages have a single representation that only concerns the structure of the language; or does the interaction of syntactic information depends on lexical information? The present study aimed at contributing with the discussion of syntactic processing in bilinguals, more specifically, BP-English bilinguals, which up to my knowledge, have never been investigated in terms of syntactic processing.

When priming happens from one language to another it indicates the two languages systems are somehow integrated (Branigan & Pickering, 2016). If the two systems share similarities and have the same word order, as in the case of BP and English in relation to passive voice, it is plausible to think that the two languages will efficiently process this syntactic aspect in similar ways (Hartsuiker et al., 2004).

The findings from this cross-linguistic passive sentence comprehension study with BP-English have led to the conclusion that these two syntactic systems are lexically driven. The condition in which prime and target sentences shared the same grammatical structure but were not translation equivalents was not sufficient to provoke syntactic priming. Neither was the condition in which there were shared translations equivalents with active and passive sentence. However, when prime and target sentences shared translation equivalents and the same syntactic structure (Condition 1), there was a reduction in time of processing of the auxiliary verb of the passive voice (verb to be/*ser*) and

of the critical region of the target structure (auxiliary verb + past participle of the verb + by-preposition). Therefore, taken together, the results of the present study show that shared translation and shared structures together were pertinent to provoke syntactic priming between languages. Also, the component of be-passives, the auxiliary verb, showed significant priming for Condition 1, instead of only reduced RT for the main verb of the structure.

It is important to strengthen that Hartsuiker et al.'s (2004) shared-syntax model was proposed to explain bilingual syntactic representation during production. The comprehension modality, however, can still be supported by this lexicalist model, in the sense that the abstractness of the syntax is encoded in the lexicon speakers encounter when engaging in reading activities. This can explain why priming between PB-English bilinguals was found only when prime and target shared the same translation, since according to Hartusiker et al's (2004) model, the lemma stratum activates its counterparts in both languages by activating the encoded syntactic information, thus providing facilitation in the processing of a subsequent sentence. The fact that the configuration of passive structure was similar in both languages was significant to provide evidence of integration between systems, as long as when they shared translation equivalents between sentences. The results indicate a trend towards the MUC Model (Hagoort, 2003, 2005, 2013, 2016, 2017), although it is a neurocognitive model of L1 processing, it states that syntactic processing is lexically driven, as the behavioral results of Condition 1 of this study.

5.2. LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FURTHER RESEARCH

During the whole process of this research, the best was done to control for intervening variables, but the study suffers from some limitations that further research should avoid. As pointed by Grosjean (1998), matters involving the selection of participants can play a role in the result of any language study. As addressed by Hartsuiker and Bernolet (2017), high level of proficiency relates to strong syntactic priming relying on the structure itself, rather than only being lexically boosted. So, the comparison of non-proficient bilinguals with proficient ones could provide insights whether shared syntactic representations rely on proficiency. This comparison, however, was not performed in this study because there was not a significant sample size of individuals who underperformed the proficiency test (See chapter 3.2 for clarification on

proficiency), and thus it would not provide a reliable contrast. Thus, as already considered in studies with other language pairs (e.g., Bernolet et al, 2013), it could be worth investigating proficiency in systems integration with BP-English bilinguals.

Future research also may address a different syntactic structure with specific and unique features for each language to corroborate with these results on syntactic processing. The structure of passive voice was investigated in Loebell and Bock's (2003) study, besides two different syntactic structures, and they found priming only with the structure that has the same configuration in German and English (ditransitive and prepositional datives). However, Weber and Indefrey (2009) investigated passive sentences with the same pair of language and in their study, priming was found in comprehension. Hence, investigation and even replications of the same or adapted designs can provide more perceptions on the discussion.

More insights on this topic could be addressed when researching typologically different languages, structures that have different word order, pairing BP with other languages as well, or even investigating with individuals who know more than two languages (e.g., Hartsuiker et al., 2016). Additionally, syntactic priming could be addressed with BP-English in production to investigate whether shared translations are also significant in a different modality, and as well as with different methodological techniques, such behavioral methods that include physiological data (e.g., eye-tracking) or neuroimaging techniques (e.g., EEG/ERPs, fMRI). The use of neuroimaging techniques would allow for investigating cross-linguistic syntactic priming effects in BP-English bilinguals in the light of neurocognitive models that make predictions about syntactic processing, such as the DP Model (Ullman, 2001) and the MUC Model, thus contributing to distinguishing these models. Last, although the present study was not designed to yield pedagogical implications, further research could investigate cross-linguistic syntactic priming taking context of learning (e.g., instructional versus naturalistic learning) or learning condition (e.g., implicit versus explicit learning condition) as factors.

Bilingualism is a complex phenomenon and many questions regarding how our neurocognitive apparatus goes about the task of juggling two or more languages are still unanswered. Given its centrality in language processing, syntax is an important item in the agenda of research on bilingualism. The present study aimed at making a modest contribution to the area by addressing syntactic priming effects in BP-English speakers.

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APPENDIX A - Consent Form

UNIVERSIDADE FEDERAL DE SANTA CATARINA
CENTRO DE COMUNICAÇÃO E EXPRESSÃO
PROGRAMA DE PÓS-GRADUAÇÃO EM INGLÊS: ESTUDOS LINGUÍSTICOS E LITERÁRIOS
LABLING – LABORATÓRIO DA LINGUAGEM E PROCESSOS COGNITIVOS

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

Termo de Consentimento Livre e Esclarecido (TCLE) baseado na resolução 466/2012 de acordo com o CNS (Conselho Nacional de Saúde).

Caro (a) Senhor (a):

Eu, Adriana Rocha Felicio, CPF XXXXX, aluna regularmente matriculada no Mestrado em Inglês: Estudos Linguísticos e Literários da Universidade Federal de Santa Catarina, tenho como objetivo desenvolver um estudo sobre os efeitos da repetição de sentenças em falantes bilíngues, como requisito parcial para a obtenção do título de Mestre em Inglês.

Gostaria de convidá-lo(a) a participar do meu estudo, que busca investigar os efeitos de repetição de sentenças em português e inglês. Pretendemos, com esta pesquisa, contribuir para o corpo de estudos sobre o papel facilitador da repetição no processamento da linguagem. Peço que você leia atentamente este termo de consentimento e tire todas as dúvidas que possam surgir, antes de concordar em participar do estudo.

Objetivo do estudo: O objetivo geral deste estudo é investigar os efeitos da repetição de sentenças no processamento de bilíngues do português-inglês.

Procedimentos:

Instrumentos: Se você concordar em participar desse estudo, você será solicitado, primeiramente, a responder um questionário e a fazer um teste de proficiência em segunda língua (inglês) online.

Questionários: O questionário pede informações básicas sobre a sua pessoa e informações sobre sua aprendizagem do inglês, que serão mantidas em sigilo, servindo apenas de controle para a pesquisadora.

Teste de proficiência online: Neste teste será verificado o nível de seu conhecimento gramatical em inglês.

Experimento: Você também será solicitado(a) a realizar um experimento em que você vai ler sentenças na tela do computador e vai responder perguntas sobre as sentenças usando o teclado. A tarefa não levará mais que 25min.

Benefícios: A sua participação no experimento será voluntária e contribuirá para a pesquisa sobre os efeitos de priming sintático da língua materna para a segunda língua. Durante os experimentos, você terá a oportunidade de avaliar seu nível de conhecimentos gramaticais em inglês.

Riscos: Em todas as pesquisas, mesmo de forma involuntária, existe a possibilidade de submeter os sujeitos a baixos riscos. A participação na presente pesquisa envolve possíveis riscos inerentes a qualquer situação de avaliação, como nervosismo, constrangimento e cansaço. Visando minimizar estes possíveis riscos, serão feitas sessões de prática antes da aplicação das tarefas no computador, de maneira que você possa se familiarizar com os procedimentos e sanar eventuais dúvidas, sentindo-se mais tranquilo e confiante.

Desconforto: É possível que durante a realização dos experimentos, você sinta certo desconforto, tal como cansaço visual por ter que ler várias sentenças. Certificaremos-nos de que o ambiente do Laboratório da Linguagem e Processos Cognitivos (LabLing) ofereça condições satisfatórias de conforto, além de iluminação e temperatura adequadas e do mínimo possível de ruídos externos.

Direito dos participantes: Você é livre para decidir se deseja participar ou não desse estudo. Como a participação é voluntária, você poderá desistir a qualquer momento sem nenhum prejuízo a você. Caso você tenha algum prejuízo material ou imaterial em decorrência desta pesquisa, poderá solicitar indenização, de acordo com a legislação vigente. Ao aceitar participar desta pesquisa, duas vias deste documento serão assinadas por você e pelo pesquisador responsável. Guarde cuidadosamente sua via, pois este documento assegura seus direitos como participante.

Compensação Financeira: Não existirão despesas pessoais ou compensações financeiras relacionadas à participação neste estudo. Qualquer despesa adicional será absorvida pelo orçamento da pesquisa.

Utilização dos dados: As informações desta pesquisa serão confidenciais e os resultados do estudo serão divulgados apenas em eventos ou publicações científicas, não havendo identificação dos voluntários a não ser entre os responsáveis pelo estudo, sendo assegurado completo sigilo sobre sua participação. Não haverá nenhuma informação que leve à identificação do participante aqui nomeado.

Contatos: Qualquer dúvida sobre esta pesquisa poderá ser esclarecida com Adriana Rocha Felicio, através do e-mail XXXX ou pelo telefone (48) XXXX, ou com a Professora Dra Mailce Borges Mota pelo telefone (48) XXXX ou e-mail XXXX, ou no prédio do CCE / UFSC, Bloco B sala 513.

Comitê de Ética em Pesquisa (CEP): o CEP é formado por pessoas que avaliam se a proposta de pesquisa apresenta riscos ou se pode ser prejudicial aos participantes. O projeto desta pesquisa foi avaliado e aprovado pelo Comitê de Ética em Pesquisa da Universidade Federal de Santa Catarina (CEPSH – UFSC). Caso você tenha alguma dúvida sobre este estudo, entre em contato com o CEPSH – UFSC pelos telefones (48) 3721-6094 ou pelo e-mail:cep.propesq@contato.ufsc.br

TERMO DE ACEITE

Eu, _____, Documento de Identificação _____ li este documento (ou tive este documento lido para mim por uma pessoa de confiança) e obtive dos pesquisadores todas as informações que julguei necessárias para me sentir esclarecido e optar por livre e espontânea vontade participar desta pesquisa. O pesquisador responsável, que também assina esse documento, compromete-se a conduzir a pesquisa de acordo com o que preconiza a Resolução 466/12 de 12/06/2012, que trata dos preceitos éticos e da proteção aos participantes da pesquisa.

FLORIANÓPOLIS, _____ de 2017.

_____

(ASSINATURA PESQUISADOR)

_____

(ASSINATURA PARTICIPANTE)

APPENDIX B - Biographical and Language Background Questionnaire

UNIVERSIDADE FEDERAL DE SANTA CATARINA
CENTRO DE COMUNICAÇÃO E EXPRESSÃO
PROGRAMA DE PÓS-GRADUAÇÃO EM LINGUÍSTICA
LABORATÓRIO DA LINGUAGEM E PROCESSOS COGNITIVOS

Pesquisa: Os efeitos do priming sintático translinguístico no processamento de sentenças

Orientadora: Profa. Dra. Mailce Borges Mota (PPGI/ PPGLg/CNPq/ UFSC)
Pesquisadora: Adriana Rocha Felicio (Mestranda PPGI/ UFSC)

QUESTIONÁRIO INFOBIOGRÁFICO

A) Informações pessoais

Forneça as informações solicitadas abaixo:

1. Nome do participante: _____
2. Idade: _____ Data de nascimento: _____
3. Nacionalidade: _____ Sexo: ( ) M ( ) F
4. Telefones:
   Residencial _____ Celular _____
5. E-mail: _____
6. Profissão/ Ocupação: _____
7. Nível de escolaridade: ( ) Ensino Médio completo
   ( ) Ensino Médio incompleto
   ( ) Superior completo
   ( ) Superior incompleto
   ( ) Pós-graduação – Especialização
   ( ) Pós-graduação – Mestrado
   ( ) Pós-graduação – Doutorado

B) Informações linguísticas

Preencha ou assinale as informações abaixo:

1. Quantos idiomas você fala?
( )1 ( ) 2 ( ) 3 ( ) 4+

Quais são?_____

2. Quantos idiomas você entende?
( )1 ( ) 2 ( ) 3 ( ) 4+

Quais são?
_____

3. Você se considera fluente em sua segunda língua (L2)? (É considerado fluente aquele que consegue se comunicar na segunda língua sem precisar recorrer à língua materna)

( ) sim ( ) não

4. Com que idade você começou a aprender sua L2?
_____

5. Você se sente à vontade para conversar em L2 com alguém estranho?

( ) sim ( ) não

6. Em que contexto(s) você aprendeu a L2? (Ex.: curso no Brasil, morou no exterior)

_____
_____
_____

7. Faça uma avaliação do seu desempenho na L2. Abaixo de cada habilidade escreva (1) para **muito bom** (2) para **bom** (3) **regular** e (4) **ruim**.

Idioma	Fala	Compreensão Oral	Leitura	Escrita
Inglês	_____	_____	_____	_____

8. Você já morou num país no qual a sua L2 seja o idioma oficial?

( ) sim ( ) não

Se 'sim', responda as perguntas abaixo:

Onde você morou?
_____
Quanto tempo morou lá?
_____
Durante o tempo em que você morou no exterior, em que contexto(s) você utilizou a língua inglesa? (Ex.: em casa, na escola)
_____
_____

C) Informações pertinentes ao uso da L2

Assinale a alternativa que mais combina com você atualmente:

a) Comunico-me somente em uma das línguas (por exemplo, português);
b) Comunico-me essencialmente em português, e em L2 raramente;
c) Comunico-me essencialmente em português, e em L2 ocasionalmente (Ex.: em sala de aula apenas).
d) Comunico-me tanto em português quanto em L2, com a mesma regularidade nas duas línguas.

D) Informações pertinentes ao contexto e a exposição à L2

Com que frequência você se encontra num ambiente onde o português e a L2 possam ser utilizados alternadamente? Assinale abaixo.

a) O tempo todo;

b) Quase o tempo todo;
c) Em certas ocasiões;
d) Raramente;
e) Nunca.

Quantas horas por dia/semana você tem contato com a L2?
(Ex.: assistir TV – 2 horas por dia)

_____
_____
_____
_____