Caligrama, Belo Horizonte, v. 26, n. 2, p. 47-66, 2021

Syntactic Priming Effects During the Comprehension of Passive Voice in Portuguese:Evidence From Adult Native Speakers

Efeitos de priming sintático na compreensão da voz passiva em português: evidência de falantes nativos adultos

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Abstract: Syntactic priming refers to the facilitation that occurs in the processing of a given complex syntactic structure when the speaker has been previously exposed to the same structure or to a similar one. Using a self-paced reading task, we investigate the effects of syntactic priming during the comprehension of passive sentences in Brazilian Portuguese (BP). Adult native speakers of BP read target passive sentences in primed and unprimed conditions, with verb repetition between prime and target in both conditions. Our results show that participants read target sentences faster in the primed than in the unprimed condition, that is, after having been exposed to the same syntactic structure in a previous sentence. These findings indicate that, at least in part, the processing of passive

eISSN: 2358-9787
DOI: 10.17851/2358-9787.26.1.47-66

voice was facilitated by repeated exposure to the syntactic structure. We interpret these results as evidence of syntatic persistence and residual activation.

Keywords: syntactic priming; comprehension; Brazilian-Portuguese.

Resumo: O *priming* sintático refere-se à facilitação que ocorre no processamento de uma estrutura sintática complexa quanto o falante é previamente exposto a esta mesma estrutura ou a uma estrutura semelhante. Usando uma tarefa de leitura auto-monitorada, investigamos os efeitos de *priming* sintático durante a compreensão de sentenças passivas em português brasileiro. Falantes nativos adultos foram solicitados a ler sentenças na voz passiva antecedidas por uma sentença *prime* também na voz passiva ou por uma sentença *prime* na voz ativa. Em ambas as condições o verbo principal foi repetido entre sentença *prime* e sentença alvo. Nossos resultados mostram que os tempos de leitura da sentença alvo são menores quando estas são antecedidas por uma sentença *prime* na voz passiva. Estes resultados indicam que, pelo menos em parte, o processamento da voz passiva foi facilitado pela exposição repetida. Interpretamos esses resultados como evidência de persistência sintática e ativação residual.

Palavras-chave: priming sintático; compreensão; português brasileiro.

1 Introduction

The organization and nature of linguistic knowledge in our cognitive architecture and how this knowledge is used when we comprehend or produce language are core topics of investigation in psycholinguistics (BRANIGAN; PICKERING, 2016). In the course of language production and comprehension, language users have to create and interpret connections between words, so that their individual meaning combined creates new compositional meanings (CHOMSKY, 1986; HEIM; KRATZER, 1998, among many others). This on the fly composition is called syntactic processing, which is a core element of language processing as a whole (FODOR, 1983; FERREIRA; CLIFTON, 1986, *inter alia*).

Syntactic processing relies on a certain degree of abstraction, since the way language users combine words into larger pieces and understand them is based on knowledge that is not explicitly taught, but potentially generalized (see CHOMSKY, 1986, among many others). That is, language acquisition and use does not require explicit instruction on how to combine words into new sentences. In order to investigate the

processing of such abstract implicit knowledge, in the present paper we use the experimental paradigm of syntactic priming.

Priming is a construct originally found in the field of cognitive psychology (LASHLEY, 1951). Currently, priming is seen as both a phenomenon and a method. As a phenomenon, priming is, broadly speaking, the effect that previous stimuli have on the following target (BERMEITINGER, 2015). As a method, priming is largely used in experimental psychology and in language studies, especially in psycholinguistic experiments. According to Branigan and Pickering (2016, p. 6), the assumption behind the use of priming to study language processing is that "if processing one stimulus affects the subsequent processing of another stimulus, then these stimuli share some aspect of their representation". With that in mind, researchers have adopted the syntactic priming paradigm to investigate the processing of syntactic structures experimentally (see MAHOWALD *et al*., 2016 for an overview).

Based on the literature on syntactic priming, we investigated the processing of passive sentences by Brazilian Portuguese adult native speakers. We ran a behavioral syntactic priming experiment measuring response times in a self-paced reading task. The behavioral psycholinguistic literature on syntactic priming in Brazilian Portuguese has addressed both production (GUIMARÃES, 2018; TEIXEIRA, 2016; TEIXEIRA; BUCHWEITZ, 2019) and comprehension (KRAMER, 2017; KUERTEN, 2017). Here we aim at contributing to the study of syntactic processing in Brazilian Portuguese by providing further behavioral evidence regarding syntactic priming effects during sentence comprehension.

2 Syntactic priming

Syntactic priming is a phenomenon in which the previous exposure to a syntactic structure facilitates the processing of a similar, subsequent structure or induces the production of a similar structure in the following sentence (PICKERING; BRANIGAN, 1999, among many others). Syntactic priming effects can shed light on important issues regarding the nature of linguistic representation and knowledge used in language production and comprehension. According to Bock (1986), while phonological and semantic priming effects can be accounted for as the result of the activation of elements in the same representational network, syntactic priming effects cannot be accounted for in the same way due to its complex nature. In her seminal study, Bock (1986) used the priming paradigm for the first time in order to investigate syntactic processing. She investigated whether speakers that produced a given syntactic

structure would have a higher probability of reusing the same structure afterwards. Her results show that the use of a given abstract structure increases as language users are exposed to a similar struture previously presented. Her findings have had both methodological and theoretical implications. In terms of methodological implications, according to Bock (1986), the priming paradigm enables structural manipulations without conceptual changes, such as the alternation between passive and active voices. Bock (1996) argues that it is possible to test effects on syntactic processing separately from other components of language processing (*e. g.*, semantics). The theoretical implications are related to the nature of syntactic processing, since her findings indicate that, at least at some level, syntactic processing is isolated from other types of information.

Since the experiments conducted by Bock (1986), there has been a growing body of research on syntactic priming in language production (TOOLEY; TRAXLER, 2010). According to Jaeger and Snider (2013), in language production "syntactic priming refers to the increased probability of re-using recently processed syntactic structures" (p. 57). In turn, such increased probability can address the relation between lexical and syntactic knowledge. That is, if syntactic knowledge is independent of lexical knowledge, syntactic priming effects will not be sensitive to any non-syntactic manipulations in the prime. However, if both types of knowledge are shared, that is, if syntactic knowledge is encapsulated in lexical knowledge, then non-syntactic manipulations in the prime may yield priming effects. In light of this debate, Bock *et al*. (1992) found both content sensitive and purely syntactic priming effects. Moreover, Messenger *et al*. (2012) reported syntactic priming effects in semantically different sentences, thus suggesting the existence of a purely syntactic representational level. It seems, thus, that priming effects are found regardless of semantic similarity across sentences, *i. e*. prime and target sentences need not share the same content in order to trigger priming effects.

More than addressing issues related to lexical processing, data gathered in syntactic priming experiments has also enriched the debate on syntactic representation, that is, the organization and nature of the syntactic information to be accessed (PICKERING; FERREIRA, 2008). For instance, Pickering and Branigan (1999) proposed that due to the shared nature of syntactic information in language production and comprehension, speakers would represent such information only once. Hence, syntactic priming effects would be the result of residual activation thus decreasing the computational load of representing the same information twice (see also SEGAERT *et al*., 2011).

Regarding Brazilian Portuguese (BP), Teixeira (2016) and Teixeira and Buchweitz (2019) investigated syntactic priming effects during the production of passive and active sentences by Brazilian children and adults. In BP, the alternation of active-passive voice is one of the syntactic structures of interest in syntactic priming studies (TEIXEIRA, 2016; KRAMER, 2017; KUERTEN, 2017; De JESUS, 2018; TEIXEIRA; BUCHWEITZ, 2019). In this vein, priming effects are expected on passive strucutures, since (i) less frequent syntactic structures are more likely to yield priming effects (e.g. BOCK, 1986; HARTSUIKER *et al*., 2004; JAEGER; SNIDER, 2013); and (ii) passive sentences are less frequent than active sentences, apparently also in BP (TEIXEIRA, 2016; KUERTEN, 2017; LIMA JÚNIOR, 2018, *inter alia*). In Teixeira (2016) and Teixeira and Buchweitz (2019), as expected, priming effects were found for passive sentences during production. Surprisingly, however, these effects were found only in children. Teixeira (2016) and Teixeira and Buchweitz (2019) interpreted their results as evidence in favor of the implicit learning account (CHANG *et al*., 2006). According to Chang *et al*. (2000) and Chang *et al*. (2006), syntactic priming effects may be due to adaptations to experience, that is, implicit learning: a tedency to generalize alternative syntactic structures to other utterances. According to Teixeira (2016) and Teixeira and Buchweitz (2019), children are more susceptible to priming effects because of their lower exposure to language, especially to passive sentences, when compared to adults. This might make them more sensitive to a less frequent structure (the passive voice).

Two well-known explanations for the effects of syntatic priming in production have been put forth in the literature: residual activation and implicit learning. According to the residual activation account, syntactic priming effects take place when the activation of the representational nodes leave behind some residual traces. That is, after having been activated the nodes have their subsequent activation facilitated (PICKERING; BRANIGAN, 1999). Differently, the implicit learning account explains priming effects as the result of a cognitive adaptation mechanism that generates learning (DELL; CHANG, 2014). Although not mutually exclusive, these approaches make different predictions with respect to syntatic priming in production (see some discussion in SEGAERT *et al*., 2011 and in section 2.1 below). Although still less studied than syntactic priming during production, syntactic priming effects during language comprehension are also addresed in the literature. In the following subsection, we present some studies on syntactic priming effects during comprehension.

2.1. Syntactic priming in language comprehension

Interest in priming during comprehension has increased over the last years. Branigan, Pickering and McLean (2005) investigated syntactic priming effects in the interpretation of ambiguous prepositional phrases in which the ambiguity was created due to the competition between high and low attachments, such as *The waitress prodding the clown with the umbrella*. Their results suggested that participants were more likely to interpret ambiguous phrases as highly attached if the prime phrase had the same high attachment as well as the same main verb.

An important debate emerged addressing the role of a crucial variable in the studies of syntactic priming effects in language comprehension: the lexical repetition between prime and target in the critical region, which results in a "lexical boost". Considered the most consistent moderator of syntactic priming effects in the studies analysed by Mahowald *et al*. (2016), the lexical boost increases the magnitude of syntactic priming effects. Yet, in language production, the lexical boost is not a *sine qua non* of syntactic priming effects, since these effects can occur in the absence of lexical repetition. In language comprehension, however, the interdependence of lexical and syntactic representation and processing remains debatable since, in many studies, priming effects only occur in the presence of lexical repetition (e.g. ARAI; VAN GOMPEL; SCHEEPERS, 2007). Other studies, such as Thothathiri and Snedeker (2008), found syntactic priming effects independent of lexical repetition in three comprehension experiments in which participants should act out double-object or prepositional-object dative sentences while their eye movements were recorded. Despite that, the facilitative role of lexical repetition in comprehension is well accepted among researchers. Pickering and Branigan (1998) and Segaert *et al*. (2011), among others, interpret the lexical boost as evidence for syntactic persistence. Their account proposes that syntatic priming is tied to an activation effect of syntactic frames in short-term memory. According to Segaert *et al*. (2011), while the implicit learning account has no prediction with respect to the lexical boost (but see BOCK; GRIFFIN, 2000 for a different account), an activation-based account, as proposed by them, predicts that a passive sentence to a greater extent increases the activation of a passive voice for the same verb, but to a smaller extent for different verbs.

Regarding syntactic priming effects during comprehension of BP sentences, Kramer (2017) found a greater syntactic priming effect during the comprehension of passive structures by 5th and 6th grade poor readers than by 6th grade good readers. For Kramer (2017), these results indicate

that syntactic priming effects become smaller as language develops. Kuerten (2017) conducted a self-paced reading study to investigate syntactic priming effects in BP in children with dyslexia. Her results indicated that syntactic priming effects for passives were greater than for actives as well as long lasting and cumulative. Compared to the control group, of non-dyslexic children, dyslexic children experienced greater priming effects. These results go in the same direction as Teixeira (2016) and Teixeira and Buchweitz (2019), favoring an account based on implicit learning for the processing of passive sentences during production in BP.

Finally, De Jesus (2018) investigated syntactic priming effects by analysing event-related potentials (ERPs) elicited during the comprehension of BP passive sentences in a reading task performed by adults. Her experimental design consisted of conditions in which prime and target sentences did not share the same main verb, i.e., there was no lexical repitition. Her results showed an order by condition effect: priming was found only in one particular order of presentation of the conditions**.** Overall, the main component that indexed syntactic priming effects in previous ERP studies, the P600 (e.g., TOOLEY; TRAXLER; SWAAB, 2009), did not show consistent statistical significance. That is, her overall findings suggest that the processing of the passive voice by BP adult speakers was not facilitated by the previous processing of the same syntactic structure. De Jesus (2018) argued that syntactic priming effects during comprehension may be dependent upon lexical repetition and further research should address such issue.

Summing up, syntactic priming effects during production and comprehension have been reported in the literature (e.g. BOCK, 1986; PICKERING; BRANIGAN, 1998, *inter alia*). However, in Brazilian Portuguese these effects are inconsistent, especially with respect to adult native speakers. On the one hand, priming effects during comprehension were found for BP in studies with children –poor readers (KRAMER, 2017) or with dyslexia (KUERTEN, 2017). On the other hand, priming effects are weak or non significant in studies with adults, both in production (e.g., TEIXEIRA, 2016) and in comprehension (DE JESUS, 2018). In principle, these results suggest that (i) implicit learning takes place when children with reading difficulties or dyslexia are exposed to passive sentences; and (ii) syntactic activation does not seem to influence BP adult native speakers with respect to the production or comprehension of passive sentences. While (i) follows straightforwardly from what the literature on priming in other languages have reported, (ii) is unexpected,

given that priming effects in adult native speakers have been found for English (BOCK, 1989, among many others) and Dutch (SEGAERT *et al*. 2011), for instance. One way to address (ii) is to investigate syntactic priming with lexical repetition, since this is generally accepted to be the most likely context to find priming effects (e.g. BRANIGAN *et al*., 2005). This paper, thus, attempts to provide empirical data regarding the effect of syntactic representations on the processing of subsequent passive structures read by BP adult native speakers. In the following section, the methodological procedures of the present study will be presented.

3. Method

Our experimental design was based on De Jesus (2018) with adaptions in order to include conditions with lexical repetition of the main verb. Based on De Jesus (2018), we built a self-paced reading experiment in which response times were measured. We addressed the following research question:

Are BP adult native speakers susceptible to syntactic priming effects during the comprehension of BP passive sentences in which prime and target sentences share the same main verb and syntactic structure?

Our hypotheses were the folowing: (i) based on De Jesus (2018), if typical BP adult native speakers are not sensitive to implicit learning and to syntactic persistence (or activation), there will be no priming effects on the processing of BP passive sentences; (ii) on the other hand, assuming that typical BP adult native speakers are not sensitive to implicit learning, if there is syntactic priming effects during the processing of BP passive sentences during comprehension, then BP adult native speakers are susceptible to syntactic persistence/activation.

The available literature points to an interaction between lexical repetition of the main verb and syntactic priming effects during comprehension (e.g. BRANIGAN; PICKERING; MCLEAN, 2005; TOOLEY; TRAXLER, 2010). That is, syntactic priming effects during comprehension are more likely to occur when prime and target sentences share the same main verb. Also, as mentioned before, Segaert *et al*. (2011) emphasize that their activation-based approach to syntatic priming predicts a greater effect when the main verb is the same in target and prime sentences. In light of that, we hypothesize that participants' reaction times should be faster for the main verb of the target sentence of

the experimental condition (a sequence of two passive sentences) when compared to the main verb of the target sentence in the baseline condition (a sequence of an active sentence followed by a passive sentence).

3.1. Participants

Twenty-two undergraduate students at the Federal University of Santa Catarina participated in the present study. They were recruited through announcements as well as via private messages. Their ages ranged from 18 to 30 years old (*M*=23, *SD*=2.90). Based on data pre-processing (see section 4.1), the final sample consisted of 20 participants (11 female). All participants were native speakers of Brazilian Portuguese. None of them reported health or mental condition diagnosed by a medical professional. Prior to participating in the study, all participants provided written consent, in accordance with the guidelines of the Ethics Committee for Research on Human Beings of the Federal University of Santa Catarina.

3.2. Instruments and materials

Two instruments for data collection were used in the present study: a questionnaire for biographical information and a self-paced reading task. The main objective of the self-paced reading task was to determine whether reading a passive sentence would facilitate the processing of a following sentence with the same syntactic structure and main verb. The time taken to move from one word to the next in each sentence was measured in both the experimental and baseline conditions.

The self-paced reading task consisted of 240 sentences (120 experimental sentences and 120 filler sentences), each one consisting of 6 words. Sentences were not repeated as target or prime across conditions. Both types of sentences (experimental and fillers) were taken from De Jesus (2018), with adaptation in the case of the experimental sentences. In De Jesus (2018), all sentences were previously tested in an acceptability judgments task and those that were judged one standard deviation below the mean were discarded.

Our experimental design consisted of an experimental condition and a baseline condition. The experimental condition was a sequence of two passive sentences, a prime and a target, each sentence consiting of 6 words, such as in example (1). The baseline was a sequence of an active

(prime) and a passive (target) sentence (also 6 words each sentence), such as in example (2) below. Since more complex and infrequent structures are more likely to yield syntactic priming effects (JAEGER; SNIDER, 2013), we chose the passive structure as our target.

(1) Experimental Condition

a. O carro foi vendido pela mulher. [The car was sold by the woman.]
b. A mesa foi vendida pela senhora. [The table was sold by the lady.]

(2) Baseline

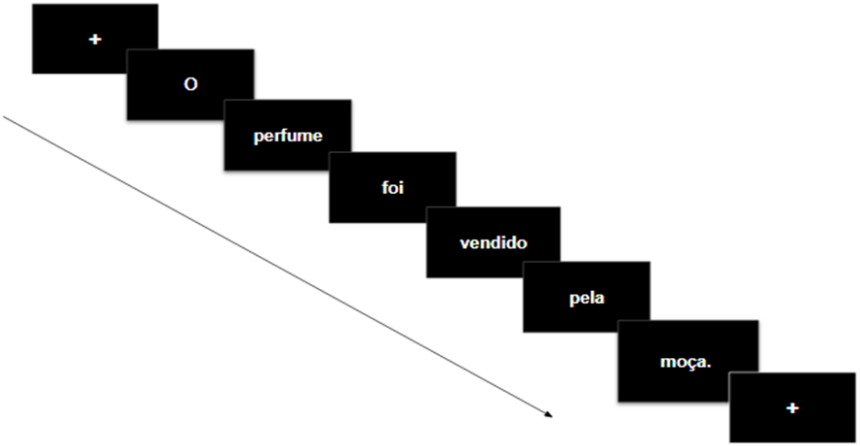
a. O rapaz loiro achou o dinheiro. [The blonde boy found the money.]
b. A cachorra foi achada pela cuidadora. [The dog was found by the caregiver.]

Since the experimental sentences of De Jesus (2018) were adapted for the present study, we retested the experimental items in an online acceptability judgment test with BP adult native speakers. Sentences were assessed on a 5-point Likert scale, from not acceptable (score value =1) to completely acceptable (score value=5). Sentences with an average score higher than 3.5 were selected for the study.

The experimental task was split into 20 blocks consisting of three trials each. Every trial had a prime sentence (such as 1a or 2a), a target sentence (such as 1b or 2b) and two filler sentences. In order to control for participants' attentional dispersion, yes/no comprehension questions were included after every block. These questions were always related to the last sentence of the trial (a filler).

The self-paced reading task was programmed in the E-Prime 2.0 software (Psychology Software Tools, Pittsburgh, PA). Each sentence appeared word by word in the middle of the computer screen, in white Arial font (size 20) on a black background on a DELL 23-inch widescreen monitor. Participants were instructed to press the space bar on the keyboard after reading each word so that the next word would appear. Their reaction times were automatically measured and recorded. Before 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 sentence could appear. An example of the presentation of a sentence is shown in Figure 1:

Figure 1 – Experimental design of a passive sentence presentation



Source: the authors.

3.3. Procedures

After giving their informed consent and before they started the self-paced reading task, participants were invited to answer a questionnaire for biographical information on Google Forms platform. Participants were then introduced to the self-paced reading task and were given a practice session consisting of 10 trials. The actual experiment lasted approximately 25 minutes. Participants were tested individually in a quiet experimental booth and their response times were recorded.

3.4. Pilot study

A pilot study with 6 BP native speakers (3 female) was carried out to test instruments and procedures. Participants signed the consent form and answered a questionnaire for biographical information before performing the syntactic priming task. Except for typos and formatting errors, no further adjustments in the instruments and procedures were necessary.

4. Results

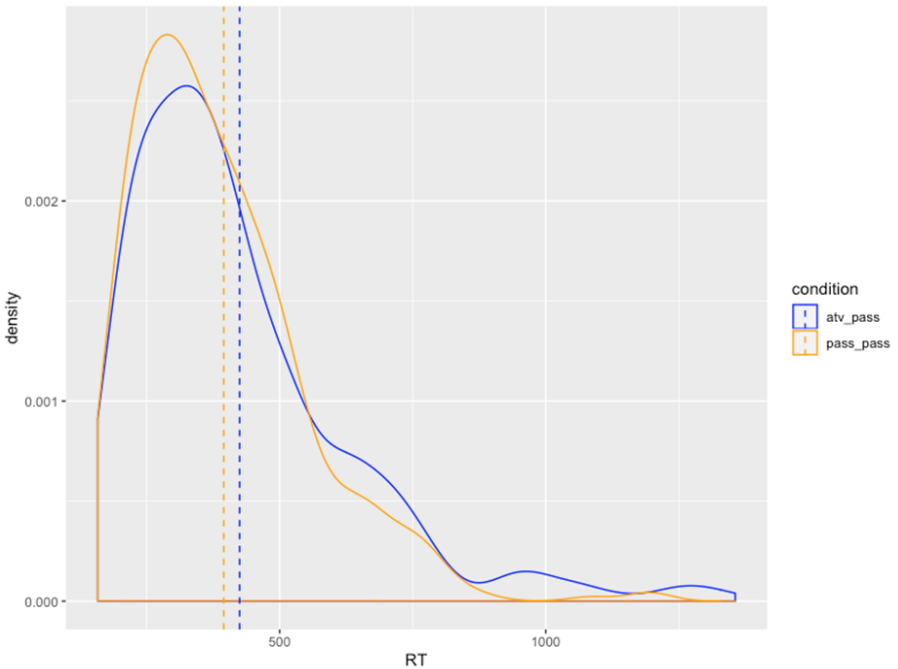
4.1. Data pre-processing

Two dependent variables were looked into during the data pre-processing procedures. First, participants' accuracy on the comprehension questions was measured (M=0.85, SD=0.1). Participants who answered correctly less than 15 out of the 20 questions were considered outliers (N=2). Second, participants' reading times were analysed. First, all values under 50ms and over 2000ms were considered outliers and thus discarded. Then, values 3SD longer than the mean by condition per region were also considered outliers and removed. After the data pre-processing procedures, the data from 20 participants remained for the analysis.

4.2. Analyses of the reaction times

As shown in Figure 2, the data was not normally distributed (Gaussian). Instead, the data seems to conform to a Gamma distribution, since there is an inferior limit (no reaction time can be negative), no superior limit (reaction times might be infinite), and more variation above than below the mean. Due to these features of the distribution of the data, a generalized linear mixed-effects model with Gamma distribution was considered as most suitable for the analysis.

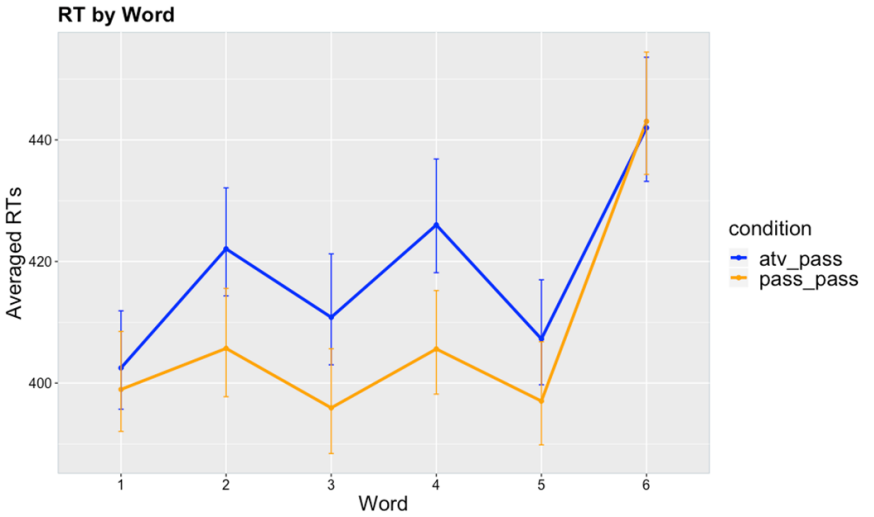
Figure 2 – Weight density curve and means of the data in the forth region (past participle)



Source: the authors.

The regions of interest were the fourth word, *i. e.* the critical region (past participle), and the fifth word, *i. e.* the post-critical region ("by" preposition), of the target (passive) sentences. For the critical region, the results indicated that previous processing of a passive structure facilitates the processing of a subsequent passive structure. While in the baseline (*atv_pass*) the RTs in the critical region averaged 426 ms, the RTs in the experimental condition (*pass_pass*) averaged 405 ms. These results are summarized in Figure 3. Error bars in Figure 3 represent 95% confidence interval in a Gamma distribution.

Figure 3 – Averaged reaction times per region in both experimental and baseline conditions



Source: the authors.

We entered the raw data into a generalized linear mixed-effects model with Gamma family and inverse link function with Condition (with levels *atv_pass* and *pass_pass*) and words' Length as fixed factors and Subjects as a random factor[1]. The maximal model is summarized in Table 1. The negative value for the *ß* coefficient indicates that the participants' reaction times were faster in the experimental condition (*pass_pass*) when compared with the baseline condition (active-passive). On the other hand, word length was found to have a marginal impact on RTs for the baseline and no effect at all for the experimental condition.

[1] Since experimental items were not minimal pairs, "item" was not included as a random effect. The experimental design, therefore, makes it impossible to use item as a random effect in the model.

Table 1 – Fixed Effects for the Generalized Linear Mixed Effects Regression in the Critical Region

	Estimate	Std. Error	t value	Pr(>|z|)
(Intercept)	469.880	19.954	23.549	< 2e-16 ***
Condition	-52.127	16.982	-3.070	0.00214 **
Length_BASELINE	-3.496	2.056	-1.700	0.08914 .
Length_CONDITION	3.042	2.367	1.285	0.19882

Source: the authors.

Finally, syntactic priming effects were restricted to the critical region, since, for the post-critical region (by-preposition), our results did not show statistical significance (see Appendix). This indicates the absence of a spill over effect. In the next section, we discuss the results.

5. General Discussion

The main objective of the present study was to investigate the occurrence of syntactic priming effects during the comprehension of passive sentences by BP adult native speakers when prime and target share the same main verb and syntactic structure. The results reported here show that BP adult native speakers are susceptible to syntactic priming effects during comprehension. The results are in line with previous studies (e.g., BRANIGAN *et al*., 2005; ARAI *et al*., 2007), in which priming effects were found for passive sentences, at least when the main verb was repeated.

With respect to previous behavioral studies on syntactic priming during comprehension in Brazilian Portuguese (KRAMER, 2017; KUERTEN, 2017), our results show that adults, and not only children (poor readers or with dyslexia), are also sensitive to syntatic priming. The occurrence of these syntactic priming effects during comprehension may be due to processes intrinsic to language comprehension, as argued by Tooley *et al*. (2009), or might have been triggered by the lexical boost. More research is needed in order to clarify the role of lexical repetition in boosting priming effects in BP adult native speakers.

The facilitatory effects on the target sentences of the experimental condition (*pass_pass*) were induced by only one prime. It is more likely, therefore, that these effects result from residual activation, rather than

implicit learning. Nevertheless, since this study was not designed to distinguish between residual activation and implicit learning as sources of syntactic priming, we can not rule out the possibility that abstract priming also occurred.

Finally, our results can shed light on De Jesus's (2018) findings to the extent that here syntactic priming effects during comprehension were found in the presence of lexical repetition of the main verb. In light of that, the priming by order of condition effects found in De Jesus (2018) might be related to the absence of lexical repetition. Looking into the structural representation of linguistic knowledge, we shall take into consideration the two different positions depicted in the literature: the lexicalist and the autonomous approaches. On the one hand, according to lexicalist approaches, syntactic knowledge is tied to individual lexical items. In this view, syntactic representation would be derived from non-syntactic representations that conduct communicative and cognitive functions. On the other hand, for autonomous approaches syntactic knowledge is independent of other forms of knowledge. Thereby syntactic representation would be organized solely based on syntactic categories. Our results favor the view that syntactic processing might be, at least to some extent, lexically driven, which is a claim of the residual activation theory (CLELAND; PICKERING, 2003; PICKERING; BRANIGAN, 1998).

Even though syntactic priming has been investigated in different languages such as English, German, Dutch and Mandarin (e.g. BOCK, 1986; CAI; PICKERING; STURT, 2013; PAPPERT; PECHMANN, 2013; SEGAERT *et al*., 2011) little is still known about its effect in Brazilian Portuguese. Our study adds evidence to the existence of priming effects in BP. Differently from languages such as English, BP auxiliary verbs for passive voice (*ser* "to be") restrict the possible interpretations to a theme before the reader gets to the past participle. In English, for instance, when the reader gets to the auxiliary verb (as in *The boy was*…), the thematic role of the subject is still uncertain (it can be an agent, for instance, if the main verb has a progressive inflection, such as …*building a toy*.), whereas in BP the subject has to be a theme, because the auxiliary verb reveals the thematic role of the subejct (as in *O menino foi chamado pelo professor* "The boy was called by the teacher." vs. *O menino estava construindo um brinquedo*. "The boy was building a toy."). This difference may also explain the weaker or inconsistent effects in the literature on priming in BP passive sentences.

6. Final remarks

Syntactic priming experiments provide empirical data regarding the nature and organization of syntactic knowledge. On that note, the present study contributes to the literature regarding syntactic priming effects during comprehension with data from Brazilian Portuguese adult native speakers. Our results indicate that adult speakers of BP are susceptible to syntactic priming effects during comprehension of passive sentences when the main verb is repeated between prime and target sentences. Given that the effects on the target sentence were induced after only one prime, we interpret these results as evidence in favor of residual activation of syntactic information. The occurrence of syntactic priming effects during comprehension in a sample of adult speakers of BP may suggest that these effects are not restricted to children.

There are two main limitations in the present study. First, we did not address the extent to which syntactic priming effects during comprehension are dependent upon lexical repetition. Accordingly, a different experimental design in which conditions without lexical repetition are included would be suitable to address this issue. Second, the design of our study does not allow us to distinguish between residual activation and implicit learning as sources of syntactic priming effects. Future research should address these sources to build further conjectures and conclusions on the nature and mechanisms of syntactic processing.

Acknowledgments

This work was supported by CAPES (Funding Code 001, awarded to the first author) and CNPq (grant 311632/2019-0, awarded to the second author, and grant 152388/2019-2, awarded to the third author).

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Appendix

Table 2 – Fixed Effects for the Generalized Linear Mixed Effects Regression with the RTs in the Post-Critical Region

	Estimate	**Std. Error**	**t value**	**Pr(>|z|)**
(Intercept)	459.222	22.554	20.361	<2e-16 ***
Condition	-11.817	7.183	-1.645	0.0999 .
Length	-7.518	4.858	-1.547	0.1218

Source: the authors.

Recebido em: 31 de março de 2021.

Aprovado em: 01 de julho de 2021.