

A SEPARATE OR SHARED SYNTAX: SYNTACTIC PROCESSING IN BILINGUALS

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ABSTRACT: The objective of the present article is to provide, from a psycholinguistic perspective, an overview of the recent literature on bilingual syntactic processing in production and comprehension. More specifically, the article aims at presenting the contributions of the syntactic priming paradigm to the study of syntactic processing in L1 and L2 by reviewing studies conducted in Brazil and abroad. Syntactic priming refers to the facilitated processing of grammatical structure due to some previously processed information or structure and it is a promising tool to study whether syntax is shared or separate in bilinguals. At the cross-linguistic priming level, the studies reviewed report robust syntactic priming effects during production. Overall, studies show cross-linguistic syntactic priming effects on different structures and different language-pairings. Production data suggests links between the L1 and L2 syntactic representations. Comprehension data remains a matter of debate.

KEYWORDS: Priming; Syntactic processing; Cross-linguistic syntactic priming; Bilingualism.

RESUMO: O objetivo do presente estudo é apresentar, em uma perspectiva psicolinguística, um panorama da literatura recente sobre o processamento sintático em bilíngues, nas modalidades de produção e compreensão. Mais especificamente, o artigo visa fazer um apanhado das contribuições do paradigma de priming sintático para o estudo do processamento sintático em L1 e L2 a partir da pesquisa conduzida em contextos internacionais e no Brasil. O priming sintático refere-se à facilitação do processamento de uma estrutura devido ao processamento prévio de uma informação ou estrutura e apresenta-se como uma ferramenta promissora para investigar se a representação sintática da L2 é compartilhada com a L1 ou dela separada. No nível translinguístico, os estudos revisados reportam efeitos robustos de priming sintático na produção. De maneira geral, os estudos reportam efeitos de priming sintático translinguístico em diferentes estruturas e diferentes pares linguísticos. Os dados em produção sugerem uma interface parcial entre as representações sintáticas na L1 e L2. Os dados em compreensão perduram como tema em debate.

PALAVRAS-CHAVE: Priming; Processamento sintático; Priming sintático translinguístico; Bilinguismo.

1. INTRODUCTION

In contemporary linguistic theory, it is consensus that languages are similar in their function and organization. Every human language has a lexicon and a grammar, components that serve as the building blocks of sentences. The grammar of a language contains a syntactic component which, in turn, carries rules that govern sentence structure (FERNANDÉZ; CAIRNS, 2011). Syntactic processing is, thus, a core element of human languages and, for

this reason, scientists have long sought to understand its cognitive and neural mechanisms, as well as its relationship to other human cognitive abilities (FEDORENKO; NIETO-CASTAÑÓN; KANWISHER, 2012). L2 syntactic processing, more specifically, has been widely investigated over the last decades and the studies carried out have not only adopted different experimental designs (i.e. longitudinal or cross-sectional) and techniques (i.e., off-line and on-line measures), but have also focused on different languages (i.e. artificial or natural languages) and communities of L2 speakers and learners (CAFARRA et al., 2015).

In language use, syntactic processing displays an interesting and familiar phenomenon: both in L1 and L2, speakers tend to repeat syntactic patterns over the course of an interaction. Loebell and Bock (2003) state that one possible explanation for the repetition of syntactic patterns is that people sometimes repeat themselves or others intentionally, and such repetitions can serve stylistic, social, and rhetorical purposes. At the same time, some kinds of repetition appear to be so subtle and effortless that it is hard to ascribe them completely to intention. Because repetition of syntactic patterns seems to be a central phenomenon of language use, researchers make use of it to illuminate our understanding of syntactic processing (PICKERING; FERREIRA, 2008) by studying *syntactic priming*¹, that is, the tendency to repeat or better process a current sentence because of its structural similarity to a previously experienced (*prime*) sentence (BOCK, 1986). In syntactic priming, there is a structural persistence in which syntactic structures are echoed from recent experience, despite changes in the meaning, in the wording, or even in the language embodying the persistent structure (BOCK, 1986; BOCK; LOEBELL, 1990; BOCK; DELL; CHANG; ONISHI, 2007; LOEBELL; BOCK, 2003). Research has shown that syntactic priming is evident in naturalistic (e.g., BOCK; DELL; CHANG; ONISHI, 2007) as well as experimental settings (e.g., HARTSUIKER, PICKERING; VELTKAMP, 2004) and in

¹ Also referred as structural priming (FERREIRA; BOCK, 2006; DELL; FERREIRA, 2016), syntactic persistence (JAEGER; SNIDER, 2007) or structural persistence (TOOLEY; TRAXLER, 2018).

utterances produced to communicate (e.g., BRANIGAN; PICKERING; CLELLAND, 2007) or to support memory (e.g., BOCK, 1986).

2. SYNTACTIC PRIMING CONTRIBUTIONS TO SYNTACTIC PROCESSING IN L2

Syntactic priming investigations help researchers to understand particular important types of repetitive phenomenon in syntactic processing (PICKERING; FERREIRA, 2008). Specifically, it may reflect processes of learning (CHANG; DELL; BOCK, 2006) or it may reflect critical communicative, imitative, or social functions (PICKERING; GARROD, 2004). The representational and processing systems that generate syntactic priming effects during language production and language comprehension compose an active area of inquiry (see PICKERING; FERREIRA, 2008, TOOLEY; TRAXLER, 2010 for reviews). Most studies that use syntactic priming or closely related methods are concerned with language production (e.g. DESMET; DECLERCQ, 2006). However, many recent studies address priming from comprehension to production (e.g., BOCK et al., 2007; VASILYEVA et al., 2010) or priming within comprehension studies (e.g., LEDOUX; TRAXLER; SWAAB, 2007). Regarding cross-linguistic priming, there is converging evidence that its effects are robust in production (e.g., LOEBELL & BOCK, 2003) while in comprehension it is still a matter of debate (WEBER; INDEFREY, 2009).

Studies in cognitive psychology, neuropsychology, and neuroscience have converged on the idea that memory is composed of dissociable forms and systems (SQUIRE, 1992). Such conclusion has been based on experimental and theoretical analyses of a variety of different phenomena of learning and memory (SCHACTER; BUCKNER, 1998). One of the most intensively studied phenomena is *priming*, i.e., a change in the ability to identify or produce an item as a result of a specific prior encounter with a previous item (TULVING;

SCHACTER, 1990). In language processing studies, priming effects can occur at phonological (e.g., PILOTTI; BEYER, 2002), semantic (e.g., NEELY, 1991) and syntactic (e.g., SEGAERT et al., 2011) levels.

Since Bock's original study (1986), syntactic priming has been studied extensively in language production. Bock (1986) was the first controlled study of the priming of purely structural abstractions during production (DELL; FERREIRA, 2016). In this investigation, primed abstractions were very much like surface syntactic structures – hierarchical phrase markers whose terminals are grammatical categories rather than lexical items (BOCK, 1986).

Similar results have been observed for a variety of different linguistic situations (e.g., BOCK; LOEBELL, 1990; BOCK; GRIFFIN, 2000; BRANIGAN et al., 2000a; CORLEY; SCHEEPERS, 2002). Syntactic priming occurs across speakers in conversation tasks, (BRANIGAN et al., 2000a), in both written and spoken forms of language production (PICKERING; BRANIGAN, 1998), in English (e.g., BOCK, 1986), German (e.g., SCHEEPERS, 2003), Dutch (e.g., HARTSUIKER; KOLK, 1998b), Spanish (e.g., HARTSUIKER et al., 2004), Korean (SHIN; CHRISTIANSON, 2009), and cross-linguistically in bilinguals (e.g., LOEBELL; BOCK, 2003; HARTSUIKER et al., 2004; WEBER; INDEFREY, 2009). Besides, syntactic priming effects have been observed in 4- to 6- year-old children (HUTTENLOCHER et al., 2004) and in analyses of natural speech corpora (GRIES, 2005).

Priming effects occur when a previous stimulus – *prime* – facilitates processing of subsequent information – *target* (FOSTER, 1999; SEGAERT et al., 2011; SQUIRE; KANDEL, 2003). Thus, priming paradigm comprises, in a typical experiment, two stimuli presented successively to the participant. The first stimulus is the prime, which must not be perceived consciously, and the second one is the target (BUCKNER; SCHACTER, 1998). The required task generated by this presentation of stimuli requires the participant to

somehow respond to the target. In this sense, it is said that priming effect occurred when there is evidence that the presentation of priming *facilitated* this response. This facilitation response can be obtained by comparing this testing condition to a control condition, in which there is no prime presentation (MCDONOUGH; TROFIMOVICH, 2009).

Recent studies demonstrate that comprehending a sentence with a particular syntactic structure can ease the process of comprehending a subsequent sentence that has the same syntactic structure (PICKERING; TRAXLER, 2004; LEDOUX et al., 2007; WEBER; INDEFREY, 2009). Nevertheless, these observed syntactic priming effects in comprehension often appear to depend more on lexical repetition across prime and target sentences than those observed in production studies. For instance, in one paradigm for investigating syntactic priming in comprehension, participants read difficult, garden-path sentences presented in prime–target pairs (such as 1 and 2, below) while having either their eye movements or electroencephalogram recorded.

1. Prime: The man *watched* by the woman was tall and handsome.
2. Target: The child *cleaned* by the girl was covered in chocolate.

Though these example sentences have the same syntactic structures, reading sentence 1 immediately before does not cause participants to read sentence 2 faster than normal (PICKERING; TRAXLER, 2004). However, if the prime and target sentences have equivalent structures, as well as the same initial verb, then target sentence reading time does decrease (as in 3 and 4, below). This priming effect has been shown for naturalistic reading using eye-tracking (PICKERING; TRAXLER, 2004; TRAXLER; TOOLEY, 2008), as well

as physiologically via the P600 component² of the event-related potentials (ERP)³ waveform to the disambiguating portion of reduced-relative sentences (during rapid serial visual presentation reading) (LEDOUX et al., 2007; TOOLEY et al., 2009).

3. Prime: The man *watched* by the woman was tall and handsome.
4. Target: The mouse *watched* by the cat was hiding under the table.

These findings may indicate that syntactic priming in comprehension is restricted to situations where the prime and target sentences share syntactic structure and a key lexical item (such as the initial verb) or that syntactic priming effects are only detectable in comprehension measures under these experimental conditions.

According to Weber and Indefrey (2009), several sentence production studies have suggested that between-language syntactic priming can reveal syntactic interaction between L1 and L2. In such investigations, the prime sentence was in a different language than the target sentence. Loebell and Bock (2003), in a seminal cross-linguistic syntactic priming study, showed that German–English bilinguals were more likely to produce an English double-object dative sentence (e.g., *The little boy wrote his penpal a letter*) to describe a picture after having produced a sentence of the same structure in German (e.g., *Der reiche Bauer kaufte seinem Sohnein Pferd*. ‘*The rich farmer bought his son a horse*’.) as compared to the alternate prepositional dative construction (*Der reiche Bauer kaufte ein Pferd für seinen Sohn*. ‘*The rich farmer bought a horse for his son*’.). The authors explain that priming effects appeared in both directions from German to English and from English to German, as well as

² The P600 component is an event-related potential (ERP) typically associated with the processing of grammatical anomalies, incongruities or level of complexity of a given structure (e.g., GOUVEA et al., 2010).

³ Event-related brain potentials (ERPs) reflect neuronal activity related to language processing with millisecond accuracy. Research has shown that electrophysiological responses differ reliably in timing, amplitude, and scalp distribution as a function of different linguistic manipulations involving phonology, syntax, and semantics for instance (e.g., LUCK, 2015; GOUVEA et al., 2010).

within German. Though, in this study, priming of passive sentences failed to produce reliable effects.

However, in a study with Spanish–English bilinguals (HARTSUIKER et al., 2004) results showed a priming effect for passive sentences in production. The researchers found Hartsuiker et al. (2004) did find significant cross-linguistic priming for transitive sentences. They had Spanish–English bilinguals describe cards to each other in a dialogue game (cf. BRANIGAN et al., 2000). Participants first heard a prime description in their L1 (Spanish) and then had to describe the subsequent picture using their L2 (English). The experiment showed cross-linguistic priming for passive sentences: Spanish–English bilinguals tended to produce English passive sentences more often following a Spanish passive than following a Spanish active or an intransitive sentence. In Spanish and English, however, passive sentences have an identical word order (see 5).

5a. Prime: The truck *is chased* by the taxi.

5b. Target: El camión *es perseguido* por el taxi.

Hence, cross-linguistic priming of transitives can occur when the word order of the sentences is the same. The differential results of Hartsuiker et al. (2004) and Loebell and Bock (2003) might be explained by assuming that not only structural overlap between languages but also surface word-order overlap is required for priming to occur (German but not Spanish passives differ from English passives in this sense) (WEBER; INDEFREY, 2009).

In Brazil, recent studies have started to address syntactic processing in L1 and in L2. Such investigations were conducted in healthy adult individuals, special populations, using neuroimaging and behavioral methods. Kuerten (2017), for example, has explored sentence processing in individuals with developmental dyslexia using the syntactic priming paradigm.

In 3 experiments, Kuerten (2017) investigated behavioral and neuronal priming effects in dyslexic and non-dyslexic children and behavioral syntactic priming effects in dyslexic and non-dyslexic adults. The experiments conducted in Kuerten (2017) employed a self-paced reading task where the syntactic structure of active and passive sentences as well as the head word (the main verb) were repeated between prime and target. Results revealed that stronger syntactic priming effects for infrequent passive structures, rather than the active frequent structures, are due to surprisal-sensitive persistence⁴ (JAEGER; SNIDER, 2007) and indicated that dyslexics differ quantitatively from non-dyslexics in processing syntax.

From a behavioral perspective, a study conducted with elementary school children investigated if the repetition of the passive voice structure in Portuguese as an L1 promoted syntactic priming effects (Kramer, 2016). The study also aimed at evaluating the students reading fluency and their reading comprehension. The methodology included the reading task created by Kuerten et al. (2016). Results demonstrated syntactic priming effects on passive sentence comprehension for both good and poor readers. These results support the claim that the passive voice is a complex structure for 10 to 12 year-old children and that previous exposure to a given structure benefits syntactic processing.

In production, Teixeira (2016) explored the effects of syntactic priming of actives and passives on children and adults. The syntactic priming paradigm of sentence production was based on research conducted by Segart et al. (2011). Overall results indicated that the effect of syntactic priming occurred in children but not in adult speakers of Brazilian Portuguese (BP). In comprehension, Santos (2017) investigated syntactic priming within and across languages in Brazilian Portuguese-French bilinguals. More specifically, the study aimed at verifying the occurrence of a within-language influence (French-French) and a cross-

⁴ Surprisal-sensitive persistence is a property of syntactic priming (or syntactic persistence). It explains that more surprising structures are predicted to prime more strongly (i.e. to lead to a bigger increase in the probability of repetition) than less surprising structures (JAEGER; SNIDER, 2008). The authors posit that the term 'surprisal' refers to the log inverse of the probability, *surprisal*.

linguistic influence (BP-French) in the processing of sentences in the passive voice. Also, Santos' (2016) study compared the magnitude of the within-language syntactic priming effect to the cross-linguistic syntactic priming effect and attempted to determine if syntactic priming effects are due to lexical repetition of the head word (main verb in the past participle) between prime and target sentences. Santos (2016) experimental design included a self-paced reading task run on native speakers of BP who had French as an L2 at the intermediate level. Results showed syntactic priming effects within language (in French) but not across languages (BP-French), and the effects depended on the repetition of the main verb within prime-target presentation of sentences. The within language syntactic priming effects were interpreted as evidence in favor of lexicalist approaches (e.g. HAGOORT, 2005; 2016), which posit that syntactic priming is lexically dependent and that all information implicated in syntactic processing is located in syntactic frames stored in the mental lexicon. From a cross-linguistic view, Santos (2016) postulates that further research with a higher number of participants and more stimuli per experimental condition in the behavioral experiment should provide clearer results, as indicated by Weber and Indefrey (2009) results with German-English bilinguals.

Investigating behavioral syntactic processing in BP-English bilinguals, Felicio's (in preparation) design also employs the syntactic priming paradigm. The study aims at investigating syntactic priming effects within language (BP-BP) and at the cross-linguistic level, during the comprehension of BP-English sentences. As in Santos (2017), passive voice is the target syntactic structure. Syntactic priming effects were elicited by means of a self-paced reading task in which experimental prime and target sentences were presented in two conditions: structure repetition and translation. In this protocol, control sentences were in the active voice. Based on recent literature (e.g. WEBER; INDEFREY, 2009), Felicio (in preparation) tested hypotheses of the shared-syntax account, which states that at least parts of

the L1 and L2 syntactic processing system are shared and thus interact.⁵ Preliminary results indicated significant differences for the condition in which BP passive sentences primed English sentences with translation equivalents. Overall results suggested that the processing of the critical region of the passive voice in BP influenced the processing of the same critical region in participants' L2.

In the brain, syntactic processing in the L1 activates parts of the general language processing system that are located in the middle and superior temporal lobes as well as inferior frontal regions around Broca's area (FRIEDERICI, 2002; KAAAN; SWAAB, 2002). Some evidence for a shared syntactic system between L1 and L2 comes from a number of hemodynamic studies comparing L1 and L2 sentence comprehension (e.g., WEBER; INDEFREY, 2009). In most studies, L2 sentence processing has been found to activate the same brain areas as L1 sentence processing (BOCK; LOEBELL, 1990; CHEE et al., 1999; LUKE et al., 2002; PERANI et al., 1998).

Using the event-related brain potentials (ERPs) technique, studies have examined the nature of syntactic priming in different populations, sentence types and grammatical alternations (LEDOUX; TRAXLER; SWAAB, 2007; TOOLEY, TRAXLER, SWAAB, 2009) and in languages such as Chinese (CHEN et al., 2013). In this latter study, participants were required to read prime-target sentence pairs each embedding an ambiguous relative clause (RC) containing either the same verb or a synonymous verb. A reduced P600 effect was elicited by the critical word *de* in Chinese, in the target sentence containing the same initial verb as in the prime sentence. No significant reduction of the P600 was observed in the target sentences in the synonymous condition. These results demonstrated that verb repetition but not similarity in meaning produced a syntactic priming effect in Chinese. Furthermore, these

⁵ The two competing accounts (separate-syntax and shared-syntax accounts) will be further explored in the next section of the present article.

results indicate that the syntactic priming effect in Chinese is bound to specific words rather than the simply overlap in meaning (CHEN et al., 2013).

Other recent neuroimaging studies have shown priming of target sentences for a variety of related prime types, but critically only for prime-target pairs that contain the same verb form (e.g., LEDOUX et al., 2007; PICKERING; TRAXLER, 2004). The question that remains for further investigations is why lexical overlap seems crucial to priming in comprehension in the L1. The following section will cover aspects of cross-linguistic syntactic priming studies and provide an overview of the debate on separate or shared syntactic representations for bilinguals.

3. CROSS-LINGUISTIC SYNTACTIC PRIMING: *SEPARATE OR SHARED SYNTACTIC REPRESENTATIONS?*

The cross-linguistic scope of language processing research has widened in the past twenty years (NORCLIFFE et al., 2015). The issue of the relation between linguistic representations in bilinguals is of great interest to both linguists and psychologists and has generated substantial debate. One possible scenario is that when speakers become proficient in two or more languages, the representations of the different linguistic systems may interact and influence each other. The opposite scenario is that each language in bilingual individuals operates as a relatively independent system. Much of the research carried out to distinguish these possibilities has focused on the relation between lexical items across languages (e.g. COSTA; CARAMAZZA, 1999; GREEN, 1998). Other investigations have focused on syntax.

Empirical work on the nature of syntactic representations in bilinguals can be roughly divided into two groups: research that has utilized observational methods, which has been carried out primarily on bilingual children, and research that has utilized experimental techniques, which has been done essentially with adults (VASILYEVA et al., 2010). The first

group typically involves studies that investigate cross-linguistic influence by examining the structural properties of speech in bilingual versus monolingual individuals (e.g., DE HOUWER, 1998). Evidence from this group indicates that in children acquiring two languages from an early age, certain structural properties of speech are different from those of monolingual speakers. Specifically, bilingual infants are somewhat more likely than their monolingual peers to use structures that are ungrammatical or sound awkward in their target language (NICOLADIS, 2006; VASILYEVA, et al., 2010). The second type of research exploring the nature of syntactic representations in bilinguals involves experimental techniques, particularly a priming paradigm.

The syntactic priming paradigm has been introduced in work with monolingual adults (BOCK; 1986, 1990; BOCK; LOEBELL; MOREY, 1992). Typically, in priming studies researchers manipulate the syntactic properties of input sentences presented to participants and examine whether subsequent language production or comprehension varies as a function of input characteristics. The priming paradigm has been adopted recently to investigate syntactic representations in bilinguals (VASILYEVA et al., 2010).

Syntactic priming is a promising tool to study whether syntax is shared or separate in bilinguals. If bilinguals represent the syntax of both languages separately, the activation of a syntactic structure in one language should have no influence on the activation of a similar syntactic structure in the other language (ULLMAN, 2001; 2016). On the other hand, if bilinguals have a highly integrated representation of the syntax of both languages, it should be possible to find that the activation of a structure in one language primes the activation of a corresponding structure in the other language (DESMET; DECLERCQ, 2006; HARTSUIKER et al., 2004; LOEBELL; BOCK, 2003; HARTSUIKER; PICKERING, 2008).

The separate-syntax account posits that, for example, Spanish-English bilinguals represent English and Spanish active constructions, and English and Spanish passive

constructions, separately, even though this means that some information is represented twice. One possible motivation for having separate representations is that actives and passives (for instance), though they appear superficially similar in different languages, are actually separate constructions (and indeed, the Spanish active places a preposition, *a*, before an animate direct object, but the English active does not). Additionally, having language-specific stores might lead to efficient processing if bilinguals most commonly employ one language at a time (e.g., they have a conversation in either Spanish or English). By having separate representations for syntax, the bilingual can focus entirely on the relevant language and thereby reduce the number of constructions taken into consideration (e.g., ULLMAN, 2016; HARTSUIKER et al., 2004).

On the other hand, according to the shared-syntax account, rules that are the same in the two languages are represented once. This approach has the advantage of reducing redundancy. Even if there are some grammatical differences between the languages (such as the presence or absence of a preposition), the bilingual could represent the shared aspects of the construction once, and store additional language-specific information as necessary. Additionally, sharing syntax might be efficient for bilinguals who code-switch between languages during a conversation, so that they do not need to change which store of information they access midstream (e.g., HARTSUIKER; PICKERING, 2008).

The very recent literature on cross-linguistic syntactic priming shows behavioral between-language syntactic priming effects in language production (HARTSUIKER et al., 2004; LOEBELL; BOCK, 2003; SCHOONBAERT et al., 2007), but there are to date no such studies on comprehension. Some studies are now discussed.

Loebell and Bock (2003) demonstrated that German-English bilinguals tend to produce an English double object dative sentence (e.g., The little boy wrote his penpal a letter.) to describe a picture after they produced a sentence of the same structure in German

(e.g., *Der reiche Bauer kaufte seinem Sohn ein Pferd*. ‘The rich farmer bought his son a horse.’) in comparison to the alternate prepositional dative construction (e.g., *Der reiche Bauer kaufte ein Pferd für seinen Sohn*. ‘The rich farmer bought a horse for his son.’). Results indicate priming effects in both directions from German to English and from English to German, as well as within German. This study showed that priming of passive sentences failed to produce reliable effects.

However, Hartsuiker and colleagues (2004) showed a priming effect for passive sentences with Spanish-English bilinguals. As pointed out by Weber and Indefrey (2009), the differential results of Loebell and Bock (2003) and Hartsuiker et al. (2004) might be explained by assuming that not only structural overlap between languages but also surface word order overlap is required for priming to occur (bearing in mind that German but not Spanish passives differ from English passives in this regard).

Desmet and Declercq (2006) observed cross-linguistic structural priming for relative clause attachment in Dutch–English bilingual production despite different relative clause word orders in the two languages. Although Desmet and Declercq’s study did not focus on the comparison between structural and word order effects, the results revealed that Dutch high-attachment relative clause (e.g., “*De docent adviseerde de leerlingen van de leraren die . . . waren* [*The lecturer advised the students of the teacher who . . . were*]”) primed English high-attachment relative clauses (e.g., “*The farmer fed the calves of the cow that were . . .*”) despite the different verb positions. As such, the authors claimed that hierarchical structural configuration is crucial for structural priming across languages (e.g., BOCK; LOEBELL, 1990; SHIN; CHRISTIANSON, 2009).

Schoonbaert and collaborators (2007) in a study conducted in a between-language priming paradigm of the two structures in the dative alternation in Dutch–English bilinguals found equally strong syntactic priming effects within-languages (L1->L1, L2->L2) and

between languages (L1->L2, L2->L1) when there was no lexical overlap, suggesting shared rather than merely co-activated syntactic representations for L1 and L2. The introduction of a verb repetition condition (within languages) or translation equivalent repetition condition (between languages) resulted in a verb boost effect of within-language priming and a slightly weaker boost from L1 to L2. From L2 to L1 the translation equivalent condition did not boost the effect.

Thus, evidence has shown so far that cross-linguistic priming (L1->L2 and L2->L1) also occurs for dative sentences in Spanish–English bilinguals (MEIJER; FOX TREE, 2003) and in Dutch–English bilinguals (SCHOONBAERT et al., 2007). Meijer and Fox Tree (2003) used a sentence recall task (cf. POTTER; LOMBARDI, 1998) and found that English dative sentences with a DO structure are more often falsely remembered as datives with a prepositional object after Spanish datives containing a prepositional object than after Spanish primes that contain no prepositional object. However, their task was very demanding: many participants could not remember more than half of the target sentences correctly. This resulted in a great loss of data, as these participants were excluded from the analyses. Moreover, the items in this study were not rotated across conditions, so there is a possibility that these priming effects were due to item idiosyncrasies (BERNOLET et al., 2007).

Moreover, cross-linguistic priming effects can be lexically triggered. Salamoura and Williams (2006) found L1 to L2 priming in a sentence completion task when participants simply read an isolated verb as the prime: More English PO datives were produced after Dutch verbs that could only take a PO dative (e.g., *uitreiken* [present]) than after verbs that could only take a DO dative (e.g., *besparen* [save]) and vice versa. All studies on syntactic priming across languages provide evidence for shared syntactic representations between languages.

According to Norcliffe and collaborators (2015), cross-linguistic research on language production and comprehension can critically advance psycholinguistic theory building and empirical coverage. To date, accumulated evidence suggests that cross-linguistic syntactic priming has been found for different syntactic structures (transitive sentences, dative sentences, relative clause attachment) and between different pairs of languages (German–English, Spanish–English, and Dutch–English). The only case in which priming did not occur, and hence there is no evidence for shared representations, is passive sentences in German–English bilinguals in production (LOEBELL; BOCK, 2003). Recent evidence in comprehension (e.g., WEBER; INDEFREY, 2009) indicates that functional and neural representations of syntactic structures like the passive can be shared by L1 and L2. The authors explain that one consequence of this result may be that learning a L2 syntactic structure for which an existing L1 representation can be used should be facilitated and place fewer demands on the brain regions involved (WEBER; INDEFREY, 2009).

To conclude, there is considerable behavioral evidence for syntactic priming between L1 and L2 in sentence production. These data suggest at least links between the L1 and L2 syntactic representations and, in the case of equally strong between- and within-language priming effects, even shared representations.

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Recebido em: 29/08/2017

Aceito em: 30/10/2017