Processing of literal phrasal verbs by non-native and native speakers of English: an eye movement study

O processamento de phrasal verbs *literais por falantes não-nativos e nativos de inglês: um estudo do movimento dos olhos*

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ABSTRACT: Recent research on the learning of phrasal verbs by learners of English as a second language (L2) still presents a lack of research on the nature of the processing of this type of verb in the course of learning. The main objective of the present study was to investigate the online processing of phrasal verbs by advanced learners of English as L2, native speakers of Brazilian Portuguese (BP). Sixteen volunteers (8 native speakers of BP and 8 native speakers of English) participated in an experiment in which we examined whether there were differences between the processing of literal phrasal verbs and lexical verbs. In order to do so, the participants' eye movements were recorded as they read sentences that contained one of the two types of verbs. The measures of first pass reading time and total reading time in the region of interest showed that native speakers of BP devoted more attention to phrasal verbs than to lexical verbs, which we interpreted as evidence that there is a greater cost in the processing of sentences containing phrasal verbs than in those that contain lexical verbs. The results are discussed in the light of proposals concerning the processing of phrasal verbs.

Keywords: Phrasal verbs; Processing; Eye-tracking.

RESUMO: Estudos recentes sobre aprendizagem de *phrasal verbs* por aprendizes de inglês como segunda língua (L2) ainda apresentam uma lacuna na discussão acerca da natureza do processamento desse tipo de verbo no curso da aprendizagem. O principal objetivo do presente estudo foi investigar o processamento *online* de *phrasal verbs* por aprendizes de inglês como L2, de nível avançado, falantes nativos de português brasileiro (PB). Dezesseis voluntários (8 falantes nativos de PB e 8 falantes nativos de inglês) participaram de um experimento em que foi verificado se houve diferenças entre o processamento de *phrasal verbs* literais e verbos lexicais. Para esta verificação, foi registrado o movimento dos olhos dos participantes enquanto liam sentenças que continham um dos dois tipos de verbos. As medidas de tempo de primeira leitura e tempo total de leitura na região de interesse mostraram que os aprendizes de inglês como L2 dedicaram mais atenção aos *phrasal verbs* do que aos verbos lexicais, o que interpretamos como evidência de um custo maior no processamento de sentenças com *phrasal verbs* do que naquelas com verbos lexicais. Os resultados são discutidos à luz de hipóteses sobre o processamento de *phrasal verbs*.

Palavras-chave: *Phrasal verbs*; Processamento; Rastreamento ocular.

Introduction

The present study attempts to investigate the processing of phrasal verbs, a linguistic item that has been at the center of a hot debate in linguistics due to their complex nature as lexical items and the difficulty to determine whether they are more phrase-like or word-like. The complex nature of phrasal verbs may be the source of problems to learners of English as an L2 and may also imply first language (L1) interference over the L2 (SIDE, 1990).

Phrasal verbs are verb-particle combinations characteristic of Germanic languages. In pedagogical approaches to the teaching and learning of English as L2, for instance, phrasal verbs are commonly defined as "a verb construction consisting of a verb plus an adverb particle" (RICHARDS & SCHMIDT, 2010, p. 436). Richards and Schmidt (2010) explain that, depending on the grammatical pattern in which they occur, verb-particle combinations can be distinguished between phrasal verbs, prepositional verbs, and phrasal-prepositional verbs. In phrasal verbs, the particle may be stressed and it can occur after the object. Moreover, is possible to use short pronouns between the verb and the particle. Sentences (1-3) illustrate these cases:

(1)   Turn off the light.
(2)   Turn the light off.
(3)   Turn it off.

In prepositional verbs, the verb may be stressed and the particle cannot occur after the object (4-5). Pronouns cannot separate the verb from the particle and are placed after the particle, as in (6).

(4)   I'll apply for the job.
(5)   I'll apply the job for.*
(6)   I'll apply for it.

Concerning phrasal-prepositional verbs, these combinations contain a verb, an adverb particle and a preposition, as in (7).

(7)   We must cut down on expenses.

Descriptions of verb-particle constructions such as the one presented above leave out a number of issues related to particle verbs. As pointed out by Cappelle, Shtyrov and Pulvemüller (2010), in the study of the nature of phrasal verbs, at least two questions need to be addressed. The first question is related to the linguistic status of phrasal verbs - are they better described as words or phrases? That is, are they lexical units or full syntactic structures? According to Cappelle et al. (2010), this question is not trivial since it is possible for a phrasal verb to serve as input for morphological derivations (e.g. *passer-by*), which would grant this type of verb the status of words. On the other hand, some phrasal verbs allow the verb to be separated from the particle and this, according to Cappelle et al. (2010), is a feature of phrasal structures.

The second question to be considered is related to the specific features that have to be taken into account when determining the status of phrasal verbs – how does the transparency and meaning of a phrasal verb relate to their being a word or a phrase? Like the first question, this is not trivial since some phrasal verbs have idiomatic meanings, whereas others convey literal meanings. This semantic aspect seems to have an effect on the structure of phrasal verbs with the more literal phrasal verbs (such as *walk in*) standing as syntactically assembled sequences, and the more idiomatic ones (such as *give up*) being tight lexical units (CAPPELLE et al., 2010, p. 190).

Blais and Gonnerman (2013) claim that this modular view of the lexicon versus the syntax is not enough to account for the behavior of phrasal verbs. For example, Fraser (1966) classifies phrasal verbs in three categories. The

first category is the literal category, in which the particle has an adverbial meaning, as in *She gave leaflets out*. The second category is completive, in which the particle has an end, a result sense, as in the sentence *He ate up the food*. The third category is figurative, in which the meaning of the combination of the particle and the verb is not clear, as in *They turned up late*. Thereby, as Fraser (1966) explains, the particles (e.g. out, up) can give different meanings to the verbs. The assumption that phrasal verbs are semantic units means that a transparent (literal) and an opaque (figurative) categorization play an important role in the learning of these items by nonnative speakers.

The main objective of the present study was to investigate how literal, transparent phrasal verbs and lexical verbs (one-word verbs) are processed online by advanced learners of English as L2 (native speakers of Brazilian Portuguese) and native speakers of English. Here, following Cappelle (2005) and Thim (2012), literal phrasal verbs are defined as transparent verb-particle combinations whereas lexical verbs are one-word units.

In the remainder of this article, we present a linguistic description of phrasal verbs, introduce two models that, in the context of discussion of the literal versus figurative language processing account for literal language processing, review studies on phrasal verbs in the area of L2 learning, present the eye-tracking technique and the methodological procedures adopted in the study, and report the results of a psycholinguistic experiment aimed at investigating how nonnative speakers of English as L2 process literal phrasal verbs in comparison to lexical verbs. We discuss the results in the light of recent proposals concerning the processing of phrasal verbs.

1 A linguistic description of phrasal verbs

Phrasal verbs have been addressed in different linguistic perspectives, at different times, by researchers with different types of expertise (THIM,

2012). According to Thim (2012) the term phrasal verb was first used by Smith in 1925. Since then, various definitions of the term phrasal verb have been proposed, including 'verb-particle construction' (VPC), 'particle verb', and 'verb-particle combination'. At present, linguistic descriptions of phrasal verbs highlight a number of distinct semantic and syntactic characteristics.

According to Thim (2012, p. 10) phrasal verbs consist of two components: a verb and a particle. In the present study, we adopted Cappelle's (2005) formal definition of particles, which is based on syntactic positioning of this element. Cappelle (2005, p. 1-2) states that particles are a syntactic category, whose members (the particles) do not directly govern an NP, can follow the main verb of an active clause and follow as well as precede a direct object NP. In the following examples, taken from Cappelle (2005, p. 2) the word "down" is a particle:

(8)   I took the deer *down*.

(9)   I took *down* the deer.

According to Cappelle (2005, p.1-2), "down" is a particle because it can be placed between the verb and the object NP, as in (9). In contrast, the word "downhill" cannot occur between the verb and the object NP, and for this reason cannot be classified as a particle. Particles can perform the function of a preposition. In the following sentence, the word "down" is a preposition:

(10)   The deer ran *down* the road.

As advocated in Cappelle (2005, p. 2), the NP the road is a complement of "down" and, unlike (8) and (9), it is not possible to reverse "down" and "the road". Thus, the word "down" in (10) is a preposition, which indicates the direction of the deer's motion.

The linguistic description of phrasal verbs involves pointing out semantic aspects such as the gradable notion of literal and figurative meaning. Cappelle (2005, p. 5) states that figurative verb-particle combinations refer to those combinations that are "semantically opaque, that is, combinations whose meaning cannot be entirely predicted from the meanings of their parts". By contrast, literal phrasal verbs have independently meaningful particles, that is, they possess transparent meanings (p. 119), and, can often be replaced by an antonym, as in *She pulled on/off her dress or She pulled up/down her dress.*

Literal and idiomatic verb-particle combinations are defined by a large number of shared syntactic and semantic properties. A distinction can be made between these two types of combinations, whereby 'literal' verb-particle combinations are transparent combinations, such as *walk away*, in which the verb and the particle retain their literal meaning within the combination, whereas idiomatic combinations lie within the class of fully opaque combinations, such as *make out* ('flirt, have sex'), in which neither of the two component parts has anything obvious to do with the meaning of the combination.

In the present study, we are interested in the processing of literal phrasal verbs, i.e., literal verb particle combination in comparison to lexical verbs, here defined as one-word verbs, by nonnative advanced speakers of English. Next, we present two models that address the processing of literal language. the models are proposed in the context of the discussion of literal versus figurative language processing, but are useful to the purposes of the present study in that they encompass a description of literal language processing.

2   Models of literal and figurative language processing

As seen above, some verb particle combinations have literal, transparent meanings (e.g. *walk in*), while others hold less transparent, more opaque figurative meanings (e.g. *give up*). Next, two recent models that focus on literal versus figurative language processing are addressed: The Graded Salience Hypothesis (Giora, 1997; 2002) and the Literal-Salience Resonant Model of L2 idiom comprehension, proposed by Cieślicka (2006).

The Graded Salience Hypothesis, first presented by Giora in 1997, proposes that the comprehension of literal and figurative (metaphoric) language is governed by the principle of salience. In this view, salient meanings - meanings that are conventional, frequent, familiar, and enhanced by prior context – are processed first, that is, prior to less salient, novel meanings.

The Graded Salience Hypothesis makes three assumptions concerning the processing of literal and figurative language. The first assumption is that salient interpretation has priority over less salient interpretation, which means that salient meanings will be processed faster than less salient meaning. The second assumption is that a novel interpretation of a salient meaning is interpreted sequentially, that is, the salient meaning is processed first, rejected as the intended meaning, and reinterpreted. Therefore, the more salient the (reinterpreted) language, the easier it will be to accept the intended meaning. Finally, the third assumption of the Graded Salience Hypothesis is that novel interpretation is difficult to derive as it requires contextual support for its derivation. In the Graded Salience Hypothesis, the prediction of ease of comprehension depends on the degree of salience of a certain meaning in a given context. Salient meanings (literal or figurative) should be processed first.

Both literal and figurative expressions need the same complex comprehension processes and contextual support to be understood. In the Graded Salience Hypothesis as stated above, to be salient, a word or an utterance needs to be familiar, frequent or conventional in a certain context. Although context may affect initial comprehension of a certain meaning, it

has a limited role. That is, context does not inhibit salient meanings, it runs in parallel with lexical processes (GIORA, 2002, p. 490). Given that, a word with two meanings, for instance, will be processed according to the familiarity and frequency factors, which means that, the more popular or frequent one of the meanings is, the more salient this meaning will be. According to Giora (1997), there is evidence from eye-tracking measures that regardless of the bias of a prior context in favor of the less salient meaning, participants take longer to read less salient meanings than its control word. This finding may indicate that a word's salient meaning is activated faster than the less salient/nonsalient meaning. Therefore, salient meanings cannot be bypassed.

Based on Giora's Graded Salience Hypothesis (1997, 1999, 2002, 2003), Cieślicka (2006) proposed the Literal-Salience Resonant Model of L2 idiom comprehension, which again assumes that literal meanings enjoy a more salient status than figurative meanings. That is, literal meanings have a higher salience status in online idiom processing. According to this literal salience major assumption, L2 learners process literal meanings faster than figurative meanings regardless of context, familiarity and figurative interpretation. Cieślicka (2006) used a cross-modal lexical priming experiment with 43 advanced Polish learners of English to investigate L2 idiom comprehension. Her results suggested "more priming for visual targets related to literal meanings of idiom constituent words than for targets related figuratively to the metaphoric interpretation of the idiomatic phrase" (p. 115). These findings are in line with compositional models of idiom processing, which pose that idiomatic expressions are analyzed literally. Cieślicka (2006) and Giora (1997, 1999, 2002, 2003) state that salient meanings will be activated first and processed faster than nonsalient meanings in the course of idiom processing. Specifically, Giora's hypothesis postulates that regardless of literal or figurative meaning, the salient meaning will be activated first. On the other hand, Cieślicka's assumption poses that literal meanings will be activated faster than figurative meanings. That is, for L2 learners literal meanings will always be more salient than figurative meanings. Sentences (11) and (12) are examples of literal and figurative meaning respectively:

(11) "Within seconds she realized she was *in deep water*, and that she would very soon have to swim back towards the shore."

(12) "Within seconds she realized she was *in deep water*, and that she would very soon come to regret her words" (CIESLICKA et al., 2014).

According to Cieślicka (2006) salient meanings are activated first due to the fact that "their representations in the mental lexicon are much more strongly encoded than those of the less salient meanings" (p. 121). Additionally, the author goes on to say that literal salience has do with the way L2 learners acquire the L2 language, that is, they first encounter literal meanings through formal instruction, and then have contact with figurative meanings. Therefore, literal meanings are already established in the mental lexicon, which facilitates the access to them and their subsequent processing.

In the present study we do not address figurative phrasal verbs, but focus, instead, on two types of verbs that are assumed to literal meanings to different degrees of transparency. Here, literal phrasal verbs are taken to be more opaque than one-word lexical verbs. The greater opacity and, therefore, weaker saliency, of phrasal verbs may impose greater processing demands on nonnative speakers of English than lexical verbs. In the next section, we review studies in the area of L2 learning that have investigated the role of phrasal verbs.

3 Studies on phrasal verbs in the area of L2 learning

Empirical studies on the role of phrasal verbs in L2 learning tend to focus on the reasons why L2 learners avoid using phrasal verbs. Thus, for instance,

Liao and Fukuya (2004) investigated whether Chinese learners of English as L2 avoid using phrasal verbs, specifically figurative and literal phrasal verbs. Of the eighty-five participants, forty were intermediate Chinese learners of English, thirty were advanced Chinese learners of English, and fifteen were undergraduate native speakers of English in China. The native speakers of English took a multiple-choice test in which they had to choose between a phrasal verb or one-word verb. The nonnative speakers of English took the multiple-choice test in addition to a translation test and a recall test. The results showed that advanced Chinese learners and native speakers of English had a similar performance on the multiple-choice test. However, intermediate Chinese learners tended to avoid phrasal verbs, including figurative phrasal verbs. Native speakers and advanced learners, on the other hand, had the same frequency of choice for figurative and literal phrasal verbs. Liao and Fukuya (2004) argued L2 semantic complexity played a role in the intermediate learners' performance and that proficiency has much to do with avoidance of complex structures such as phrasal verbs.

Cappelle, Shtyrov and Pulvermuller (2010) used magnetoencephalography (MEG) to record neural responses to verb-particle pairs that exist (for example, *heat up*) or infelicitous verb-particle combinations (for example, *heat down*). Twenty-one native speakers of English took part of the study. The mismatch negativity responses to these pairs were comparable to response patterns typically elicited by words, rather than sentences. The authors concluded that at a neural level, participants process phrasal verbs lexically rather than syntactically.

Matlock and Heredia (2002) investigated the processing of figurative phrasal verbs (e.g., *Paul went over the exam with his students*) and their identical verb-preposition combinations used literally (e.g., *Paul went over the bridge with his bicycle*). Matlock and Heredia (2002) found that native speakers of English accessed idiomatic phrasal verbs more quickly than their identical verb-preposition combinations used literally. For the nonnative group, on the other hand, there were no significant differences in reading times for figurative phrasal verbs over literal verb-preposition combinations, meaning that, for native speakers, the figurative, highly familiar meaning is always activated before the literal meaning. On the other hand, for the nonnative group, the literal meaning (in their case verb-preposition combinations) might have been processed first.

In the Brazilian scenario, Nunes (2013) carried out a study with 38 native speakers of Brazilian Portuguese to investigate the effects of formal planned instruction on the learning of phrasal verbs of movement in English as L2. The participants were divided into 2 groups (control and experimental). The experimental group went through 4 phases: (1) a pre-test in which noticing and accuracy of the target structure were assessed through a written protocol and production of oral narratives; (2) an instructional phase in which the experimental group received Form-focused Instruction (ELLIS, 2001) on the target language; (3) an immediate post-test right after the instruction; and (4) a delayed post-test two weeks after the instruction. The results showed that task repetition and frequency of input contributed positively to the accuracy of use of phrasal verbs of movement in oral narratives.

Given the lack of psycholinguistic research on the processing of phrasal verbs in the L2, particularly in the case of Brazilian learners of English, and taking into consideration that phrasal verbs are linguistic items that are present in Germanic languages, but absent in romance languages, thus standing as a potential source of difficulty for learners of English, the present study aims at contributing to research on the processing and learning of literal phrasal verbs, as compared to lexical verbs, by means of an online experiment that adopts eye movements as a source of data.

4 The Eye-tracking method

In the present study, the processing of phrasal verbs and lexical verbs was assessed by means of the recording of eye movements during the reading of sentences. Mitchell (2004) states that an important reason for using the eye-tracking method is that, by means of the measures recorded (e.g. fixation time, reading time, regressions, among others), it is possible to gather information about the nature of a linguistic process at a fixed point in a sentence. According to Rayner and Pollatsek (2006, p. 613), "eye movements represent one of the best ways to study language comprehension processes." Hence, psychologists are very interested in using eye movement data to analyze "moment-to-moment processing" (p. 613).

Providing eye movement data is a relatively natural process, since the decisions are computed online and the process of comprehension is not artificial. The rapid movements of the eyes are called saccades, whereas fixations are the periods of time when the eyes are static. Return sweeps take place when saccades move from the end of one line to the next. Regressions are backward movements when the participant is reading (RAYNER & POLLATSEK, 2006).

According to Rayner (1998), about 10-15% of the saccades are regressions and about 80% are extreme fixations. Rayner e Pollatsek (2006, p. 621) explain that "one of the most robust findings in studies of eye movements and reading is that the ease or difficulty associated with understanding a word during reading clearly affects how long readers fixate on that word."

Staub and Rayner (2007) explain that "Single Fixation Duration" is the time spent on the region of interest on which only a single fixation was made in the target word. "First Pass Reading Time" or "Gaze Duration" (if the region of interest is a single word) is the sum of all fixation durations made within a region of interest before exiting either to the left or to the right. In addition, "Total Time" or "Total Reading Time" refers to the sum of all fixations durations made within a region of interest. "Regression Path Duration" also known as "Go-Past Time," refers to the sum of all fixation durations which starts with the first fixation within a region of interest up to – but excluding – the first fixation to the right of this region. "Rereading" is calculated as regression path duration for the region of interest minus gaze duration or first pass reading time for this region. "Second Pass Reading Time" is the sum of all fixation durations made on a region of interest after the region was exited and reentered for the first time. "Fixation count" is the number of all fixations made within a region of interest (ROBERTS & SIYANOVA-CHANTURIA, 2013, p. 219-220). Measures such as first fixation duration and gaze duration/first pass reading time are often referred to as early measures, while total time and second pass time are late measures (STAUB; RAYNER, 2007).

Eye movements and eye-tracking measures are used to examine language processing as it happens during comprehension. With this in mind, we used two measures to examine our critical verbs: first pass reading time and total reading time.

5 Method

5.1 Research Question and Hypothesis

The main objective of the present study was to investigate the online processing of phrasal verbs, as compared to one-word lexical verbs, in English as L2. More specifically, we examined whether there were differences between the processing of literal phrasal verbs and of lexical verbs by nonnative and native speakers of English. The study pursued the following research question:

Research Question: How do both native speakers of Brazilian Portuguese learners of English as L2 and native speakers of English process literal phrasal verbs in comparison to lexical verbs?

Based on Ciéslicka (2006) and Giora (2002; 1997) and on the assumption that literal phrasal verbs and one-word lexical verbs differ in the degree of transparency, the following hypotheses were examined:

(1) *Literal phrasal verbs will demand more processing time than lexical verbs. Because literal phrasal verbs are less salient in meaning than one-word lexical verbs, there will be a greater cost in the processing of phrasal verbs than lexical verbs. The total reading time and the first pass reading time on phrasal verbs will be greater than the total reading time and the first pass reading time on lexical verbs region.*

(2) *Compared to the control group, the experimental group will display greater cost in the processing of literal phrasal verbs.*

5.2 Participants

Twenty volunteers participated in the present study and completed all phases of the experiment. Due to the presence of outliers, extreme scores were identified in the region of interest (literal phrasal verbs and control verbs). For this reason, 4 participants were excluded from the statistical analysis, two from the experimental group, and two from the control group. Thus, in total, 16 participants were included in the sample for statistical analysis. These participants were divided into two groups:

• Group 1 (experimental group) – Eight advanced learners of English as L2, native speakers of Brazilian Portuguese. The mean age of the group was 26 years (seven males).

• Group 2 (control group) – Eight native speakers of English (British English, Scottish English and American English). The mean age of the group was 24 years (five males).

This study was conducted under protocol number 39941314.3.0000.5361, which was approved in accordance with Conselho Nacional de Saúde (National Health Council) Resolution 466/2012.

5.3 Materials

Five instruments for data collection were used: (1) a Consent Form, (2) a Biographical Questionnaire, (3) a Proficiency Test, (4) a Sentence Processing Task with phrasal verbs and lexical verbs in English and (5) a Phrasal Verb Posttest in English. The procedures to conduct the present study will be presented as follows.

5.4 Apparatus

The data were collected individually in one session for each participant. First, participants were asked to read and sign the term of free and informed consent. After that, they filled out the biographical questionnaire. Then, the Brazilian participants took an online proficiency test of grammar and vocabulary in English[1]. Only the participants who achieved the advanced levels of English (C1 or C2) were selected to take part of the study.

Next, they were required to perform the sentence processing task in the eye-tracker. During the performance of the sentence processing task, the eye-tracker device (RED 500 by Sensor Motoric Instruments – SMI) recorded the participants' eyes movements. The camera-to- eye distance was 62cm. During the reading procedure, the room was artificially illuminated. A 5-point calibration was executed at the beginning of the experiment in order to control and guarantee the participants' gaze position during the reading of the sentences.

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[1] The test can be found at <http://www.examenglish.com/leveltest/grammar_level_test.htm>.

Before beginning the sentence processing task, participants were told that they would read English sentences and answer comprehension questions on the computer screen while the eye-tracker recorded their eye movements. Each participant was given a practice session to get used to the dynamics of the task. Participants had their eyes calibrated before and after the practice. Participants could practice until they felt comfortable to start the testing phase. During the testing phase, each participant read ninety-six sentences divided into two lists of 48 sentences each. Before each sentence, a cross fixation appeared for 2 seconds, in order to help the participants to fixate their eyes in the initial point of each sentence on the screen.

The sentences appeared on the screen one at a time in one line, in font size Monaco 26. They were presented in black on a light gray background. After every five sentences, one yes-no comprehension question related to the last sentence read was presented, the answer to which should be given by clicking on one of two responses shown on the screen. This task lasted about 20 minutes. Following Rayner and Pollatsek (2006), the target and control words were never presented in initial or final position in a line. As can be seen in **Table 1**, target and control words were preceded by 3-4 words and followed by 7-8 words. Since the size of the critical verbs did not match, it was necessary to divide the measures used (first pass reading time and total reading time) by the number of the characters of each verb (phrasal verb and lexical verb) to normalize target word length.

As the participant finished the sentence processing task, she/he moved to another computer to take the phrasal verb posttest. Native speakers of English followed the same procedures, except for the online proficiency test.

5.5 Sentence processing Task with phrasal verbs and lexical verbs

The sentence processing task consisted of 96 sentences in English: 16 sentences contained literal phrasal verbs, 16 sentences contained lexical verbs, and 64 sentences consisted of filler sentences. The sentence processing task was built and performed on a computer that was connected to the eye-tracker SMI RED 500 system. **Table 1** presents an example of a sentence with a literal phrasal verb and its control lexical verb showing their position in the sentence.

Table 1 – Sentences with literal phrasal verb and its lexical verb show the position of the target and the control verbs

Literal Phrasal Verb	Lexical Verb
Beautiful models usually **PUT ON** a lot of makeup during fashion shows.	Beautiful models usually **APPLY** a lot of makeup during fashion shows.

The phrasal verbs were selected from the Longman Phrasal Verbs Dictionary (2000), according to their frequency, transitivity, their matching with a lexical verb, and the lack of a cognate form in Brazilian Portuguese. Eighty phrasal verbs were tested in the Corpus of Contemporary American English (COCA) for their frequency. Following Biber et al. (1999), 40 occurrences in one million qualified a phrasal verb as frequent. The phrasal verbs selected were also categorized as literal, according to Fraser (1966). **Table 2** presents all regions of interest for the analysis of eye-movements during the processing of literal phrasal verbs and lexical verbs.

Table 2 – Regions of interest – literal phrasal verbs and control lexical verbs

Literal Phrasal Verb	Lexical Verb	Literal Phrasal Verb	Lexical Verb
Pick up	Lift	Put back	Put
Put on	Apply	Clean out	Clean
Go after	Chase	Breathe in	Inhale
Let out	Utter	Put together	Assemble
Bring out	Release	Print out	Print
Give away	Give	Run after	Pursue
Call out	Call	Pour out	Tell
Throw away	Waste	Hang up	Hang

6 Data analysis and results

6.1 Data analysis

All sentences with phrasal verbs and lexical verbs were analyzed with the software iView X and Experiment Center of SMI. The software BeGaze obtained data of the first pass reading time and total reading time in the region of interest. In order to normalize the size of the critical verbs, first pass reading time and total reading time were divided by the number of the characters of each verb (phrasal verb and lexical verb).

The data were analyzed quantitatively using the Statistical Package for the Social Sciences (SPSS) version 20.

6.2 Results

The Paired T-test assessed whether there was a statistically significant difference between the regions of interest (literal phrasal verbs and control verbs) within the group (8 native speakers of English and 8 nonnative speakers of English) according to the variables first pass reading time and total reading time.

Table 3 – Paired sample t-tests – within group (BP and NE)

Measures	N	Mean	SD	t	df	Sig. (2-tailed)
First Pass Reading Time LPV- Control	16	-.403	12.939	-.125	15	.902
Total Reading Time LPV- Control	16	5.383	10.560	2.039	15	.059

*p < .025; LPV = Literal Phrasal Verb; N = Number of participants.

As can be seen in **Table 3**, with regard to the measure first pass reading time on the regions of interest, the whole group (16 participants) read literal

phrasal verbs (M = 52.02) similar to control verbs (M = 52.42). The mean difference between the regions of interest was -.403. The results of the paired T-test showed that there was no statistically significant difference between literal phrasal verbs and control verbs (t(15) = -.125; p = .902). These results can be interpreted as evidence that the experimental group (BP) and the control group (NE) had a similar performance, that is, in the early processes, both groups (experimental and control) accessed literal phrasal verbs and control verbs without difficulty.

Regarding the measure total reading time on the regions of interest, **Table 3** shows that the whole group (16 participants) took more time reading literal phrasal verbs (M = 62.07) than lexical verbs (M = 56.69). The mean difference between the regions of interest was 5.383. The results of the paired T-test showed that the difference in total reading time between literal phrasal verbs and control verbs approached statistical significance (t(15) = 2.039; p = .059). These results can be interpreted as evidence that the experimental group (BP) spent more time rereading and reanalyzing the information of the sentences containing literal phrasal verbs than lexical verbs, but this difference is not statistically significant.

In relation to the Paired T-test, the eight nonnative speakers of English (BP) were tested for first pass reading time and total reading time on the critical regions (literal phrasal verbs and their controls), as can be seen in **Table 4**.

Table 4 – Paired T-test – Experimental Group (BP)

MeasureS	N	Mean	SD	t	df	Sig. (2-tailed)
First Pass Reading Time LPV- Control	8	2.51	17.09	.417	7	.689
Total Reading Time LPV- Control	8	8.42	10.84	2.197	7	.064

*p < .025; LPV = Literal Phrasal Verb; N = Number of participants.

The results presented in **Table 4** show that there was no statistically significant difference between literal phrasal verbs and their control lexical verbs (t(7) = .417; p = .689) regarding the first pass reading time measure. These results may be an indication that the participants of the experimental group (BP) had no difficulty accessing literal phrasal verbs in comparison to lexical verbs.

As can also be seen in **Table 4**, there was no statistically significant difference between literal phrasal verbs and their control lexical verbs (t(7) = 2.197; p = .064) regarding the total reading time measure. These results may be an indication that the participants of the experimental group (BP) reread and reanalyzed more literal phrasal verbs than lexical verbs; however, this difference is not statistically significant.

In relation to the Paired T-test, the eight native speakers of English (NE) were tested for the variables first pass reading time and total reading time on the critical regions (literal phrasal verbs and their controls) as can be seen in **Table 5**.

<div align="center">

Table 5 – Paired T-test – Control Group (NE)

</div>

Measures	N	Mean	SD	t	df	Sig. (2-tailed)
First Pass Reading Time LPV– Control	8	-3.32	6.86	-1.37	7	.213
Total Reading Time LPV– Control	8	2.34	10.01	.662	7	.529

*p < .025; LPV = Literal Phrasal Verb; N = Number of participants.

The results presented in **Table 5** show that there was no statistically significant difference between literal phrasal verbs and their control verbs (t(7) = -1.37; p = .213) regarding the first pass reading time measure for this group. These results can be interpreted as evidence that the native speakers of English (NE) did not have difficulty accessing neither literal phrasal verbs nor lexical verbs.

As can also be seen in **Table 5**, there was no significant difference between literal phrasal verbs and their control verbs (t(7) = .662; p = .529) regarding the total reading time measure. These results can be interpreted as evidence that the participants of the control group (NE) processed phrasal verbs in the same (or in a similar) manner they process lexical verbs.

7 Discussion

The results of the present study show that both early and late effects of verb processing could be detected. Essentially, early measures (first pass reading time) suggest early processes, that is, lexical access and early integration of information. Late measures (total reading time) indicate late processes, that is reanalysis of information, discourse integration, and recovery from processing difficulties (ROBERTS & SIYANOVA-CHANTURIA, 2013, p. 217). The present results suggest that literal phrasal verbs were processed faster than their control verbs by the whole group (16 participants), but since the difference between them was small, the regions of interest were processed in an equivalent manner. No statistically significant differences were observed in the early measures (first pass reading time) on literal phrasal verbs (M = 52.02) in comparison to their control verbs (M = 52.42). This means that both groups (experimental and control) accessed literal phrasal verbs and lexical verbs in the same (or similar) way. In addition, the total reading time on phrasal verbs was higher than on lexical verbs for the whole group. These results show that literal phrasal verbs were reanalyzed and reread more times than their control verbs, meaning that participants had a processing cost in these verbs. However this difference was not statistically significant, probably due to the small sample. Regarding the first pass reading time, these results suggest a similar processing pattern for the activation of lexical

and syntactic information of these two types of verbs. In relation to the total reading time, which is a measure of reanalysis of information, the results can be taken as evidence that phrasal verbs are not stored in the lexicon in the same manner that the words are. Hypothesis 1 is, thus, partially confirmed.

Hypothesis 2 stated the experimental group (nonnative speakers of English) would experience greater cost in processing literal phrasal verbs than the control group (native speakers of English). In other words, compared to the control group, the experimental group would need more time to process literal phrasal verbs than native speakers of English. This hypothesis was supported by the results of the present study. The experimental group (BP) processed literal phrasal verbs more slowly than the control group (NE). Although the participants of the experimental group were advanced nonnative speakers of English, they took longer to process phrasal verbs than the native speakers of English did.

The difference between the BP group and the NE group may lie in the fact that, as argued by Giora (1997, 2002), native speakers of English have phrasal verbs well consolidated in their mental lexicon whereas nonnative speakers of English do not. In general, phrasal verbs were processed faster by native speakers of English (which may indicate they did not have difficulty in processing) than by nonnative speakers of English.

This finding is in line with the Graded Salience Hypothesis, which states that "salient meanings are processed initially" (2002, p. 490). Our results indicate that literal phrasal verbs were more salient for the control group than for the experimental group, suggesting that for native speakers, literal phrasal verbs are more familiar, frequent, conventional and prototypical than for nonnative speakers, whereas for nonnative speakers, one-word lexical verbs are taken as more salient than phrasal verbs, even if these are literal.

Considering that nonnative speakers of English took more time to read phrasal verbs in comparison to lexical verbs, our results are also in line with

the compositional model of L2 idiom processing, which poses that nonnative speakers analyze idiomatic expressions, and multiword units in general, literally and compositionally, rather than as single units (CIEŚLICKA, 2006).

Final remarks

In this study, we investigated the online processing of literal phrasal verbs versus lexical verbs by advanced learners of English as L2 in comparison to native speakers of English. Our results show that lexical verbs (one-word verbs) are processed faster than phrasal verbs, which can be taken as evidence that phrasal verbs are not stored in the lexicon as an only unit, specifically for nonnative speakers. It should be noted, however, that this difference is not statistically significant. When comparing the groups, the present results suggest that native speakers of English process phrasal verbs faster than nonnative speakers of English do. That is, phrasal verbs are more frequent, conventional and familiar for native speakers than for nonnative speakers of English who seem to take one-word verbs as less costing.

Although used frequently in a variety of contexts, phrasal verbs are complex linguistic structures that pose challenges to learners of English as L2, even at the advanced level. Despite the studies already carried out that investigate the learning of phrasal verbs by native speakers of Portuguese (e.g., Nunes, 2013), there is still a lack of research concerning the cognitive aspects related to this linguistic structure. The present study addressed this issue by taking eye movements as a measure of online processing and our results show that English particle verbs seem to pose demands on processing for nonnative speakers, even when they have transparent meaning. Further research should investigate the nature of these cognitive demands and possible ways to treat this linguistic structure in instructional settings.

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