https://doi.org/10.5007/2175-7968.2020v40nesp2p74

THE EFFECT OF COGNATE WORDS ON LEXICAL ACCESS OF ENGLISH AS A THIRD LANGUAGE

Pâmela Freitas Pereira Toassi[1]
[1]Universidade Federal do Ceará, Fortaleza, Ceará, Brasil

Mailce Borges Mota[2]
[2]Universidade Federal de Santa Catarina, Florianópolis, Santa Catarina, Brasil

Elisângela Nogueira Teixeira[1]
[1]Universidade Federal do Ceará, Fortaleza, Ceará, Brasil

Abstract: In this paper, the results of an experimental study carried out in order to investigate the effect of triple cognates in the lexical access of speakers of English (L3), German (L2), and Brazilian Portuguese (L1) is presented. Participants performed a reading task, containing 60 experimental sentences with the following critical words: triple cognates, double cognates between Brazilian Portuguese and English, and double cognates between German and English. Participants' eye movements were recorded while they performed the task. The measures of first fixation and first reading pass times were analyzed. The results suggested that triple cognates were processed faster than their respective controls in first fixation (M: 264/311ms (cognate/control); p=0,03) and first pass (M: 407/448ms (cognate/control); p=0,05), which was interpreted as evidence of a nonselective lexical access and an integrated lexicon for the multilinguals' languages. In addition, these results contribute to the literature of lexical access of multilinguals, favoring the view that all the languages of a multilingual are active even when the speaker intends to use only one language.

Keywords: English as a Third Language; Eye Movements; Lexical Access; Cognates; Reading

O EFEITO DE PALAVRAS COGNATAS NO ACESSO LEXICAL DO INGLÊS COMO TERCEIRA LÍNGUA

Resumo: Neste artigo apresentamos os resultados de um experimento conduzido com o objetivo de investigar o efeito de cognatos triplos no acesso lexical de falantes de inglês (L3), alemão (L2), e português brasileiro (L1). Os participantes desempenharam uma tarefa de leitura, contendo 60 sentenças experimentais com as seguintes palavras críticas: cognatos triplos, cognatos duplos entre o português brasileiro e o inglês, e cognatos duplos entre o alemão e o inglês. Os movimentos dos olhos dos participantes foram monitorados enquanto eles desempenhavam a tarefa. As medidas de primeira fixação e tempo de primeira leitura foram analisadas. Os resultados sugerem que os cognatos triplos foram processados mais rapidamente do que seus respectivos controles para as medidas de primeira fixação (M: 264/311ms (cognato/controle); p=0,03) e primeira leitura (M: 407/448ms (cognato/controle); p=0,05), o que foi interpretado como evidência de um acesso lexical não seletivo e de um léxico integrado para as línguas do multilíngue. Adicionalmente, os resultados contribuem para a literatura sobre acesso lexical de multilíngues, favorecendo a visão de que todas as línguas do multilíngue se encontram ativadas, mesmo quando o falante tem a intenção de usar apenas uma dessas línguas.
Palavras-chave: Inglês como Terceira Língua; Movimentação Ocular; Acesso Lexical; Cognatos; Leitura

1. Introduction

Lexical access is one of the processes involved in reading, in which the correspondence between a words' meaning and form is made. It is defined by Reichle (774) as "the process of activating a word's meaning so that it can be used in further linguistic processing". Therefore, without lexical access being successful, integration of meaning of a whole sentence or paragraph can be compromised.

In monolingual lexical access similarities in language features of form, meaning, syntax, orthography or emotional content can lead to the activation of other words which may then compete for selection (Szubko-Sitarek). In the case of the multilingual lexicon, all of these possibilities of interference are increased due to the presence

of other languages. According to Szubko-Sitarek (67): "In the case of multilingual speakers [...] the complexity involved in L1 lexical storage and processing [...] is further multiplied by the complications added by other lexical systems, those of L2, L3, Ln."

The interaction of these two or more languages in one mind is still a matter of discussion among scholars; that is, whether the similar words will be activated only in the intended language or in all of the languages of the multilingual. This debate is centered around two perspectives. The selective view postulates that only words or lexical entries of the intended language will be activated for competition. As opposed to that, according to the non-selective view, the words/lexical entries from the bilinguals' two languages will be activated for competition.

Other factors that might constrain access to the mental lexicon are frequency, context and imageability (Szubko-Sitarek). According to the non-selective view of lexical access, it could be predicted that these characteristics of the word will be more influential in lexical access than the tag of the language from which the word belongs to. In other words, if these factors constrain lexical access, it is possible that the greatest influence, or the greatest number of activated lexical items will belong to the target language and little influence is expected from the other languages of the multilingual. Thus, the importance of investigating the multilingual lexicon, comparing lexical access of bilinguals and multilinguals.

The present study was designed with the main goal of investigating the effect of triple cognates (among English, German and Brazilian Portuguese) in the lexical access of English in a reading task. The next section presents some assumptions regarding the representation of cognate words in the multilingual lexicon.

2. The representation of cognates in the multilingual lexicon

Cognates are lexical items of similar form and meaning, which can be identical, as in German *Hand* and English hand, or not, as in the German verb *trinken* and English drink, where these non-

identical cognates with a similar form have gone through a regular phonological change in each language (Szubko-Sitarek). Both identical and almost identical cognates have an effect on bilingual language processing (Szubko-Sitarek).

The origin of cognate pairs can be etymological or through language contact, that is, borrowings from one language to the other (Szubko-Sitarek). However, in psycholinguistics, processing is more relevant than etymology when defining a cognate pair (Szubko-Sitarek). One possible definition of cognates for psycholinguistics may be related to whether the pair of words have shared aspects of spelling, sound and meaning (Szubko-Sitarek).

Cognate words might have a special representation with stronger orthographic and semantic links across the two languages (Dijkstra). Among the models of word recognition, the Bilingual Interactive Activation model (BIA+) (Dijkstra & Van Heuven) which has been extensively investigated and received empirical support from many studies (Sunderman & Kroll; Liben & Titone; Titone *et al*.; Jared & Kroll; Schwartz & Kroll; Chambers & Cooke; Van Assche, Duyck, & Brysbaert; Duñabeitia *et al*.; Kerkhofs *et al*; Perea, Duñabeitia & Carreiras) assumes that cognates have an integrated representation across the bilingual's two languages.

According to Multilink (Dijkstra *et al*.), a model that incorporates assumptions of the BIA+ model and the Revised Hierarchical Model (Kroll & Stewart), the cognate facilitation effect comes from four different sources: (1) overlap in input orthography; (2) shared morpho-semantics; (3) co-activation of their phonological representations through semantics during word production; (4) activation spreading within the language (in production) from orthographic representations to their phonological representations.

The use of cognates in research on the bilingual lexicon allows to observe the influence of the other language in a language exclusive setting (Poarch & Van Hell). Szubko-Sitarek states that if responses to cognates differ from their respective controls, it can be seen as evidence that the readings of the cognate word in the two, three or more languages have become active and affect each other.

There is evidence in the literature (Dijkstra, Grainger & Van Heuven; Lemhöfer & Dijkstra; Lemhöfer, Dijkstra & Michel; Poarch & Van Hell; Cop *et al.*; Lauro & Schwartz; Vanlangendonck *et al.*) that cognates are processed faster than non-cognate words. This is commonly referred to as the cognate facilitation effect. This effect has often been taken as evidence for an integrated multilingual lexicon and/or for parallel lexical access – the nonselective access hypothesis – where word candidates are activated in several languages (Szubko-Sitarek).

In the area of multilingualism, the effect of triple cognates (Lemhöfer, Dijkstra & Michel; Telstad; Zhu & Mok) offers an interesting source of investigation that can provide information regarding the organization of the multilingual lexicon. Therefore, the choice of these words as stimuli for the task applied in the present study in which participants' eye movements were recorded while reading.

The eye movements' technique has also been applied in studies focused on lexical access to investigate: the activation of multiple lexical items (Marian, Spivey & Hirsch), if the L2 lexicon interferes with processing of the L1 (Titone *et al.*), the effects of semantic constraints on non-selective access for interlingual homographs and cognates (Libben & Titone), the cognate facilitation effects with verbs (Van Assche, Duyck & Brysbaert), the effects of sentence context and L2 proficiency on the effects of competition of interlingual homographs (Chambers & Cooke), the processing of homophones (Yip & Zhai), and the processing of homographs (Hoversten & Traxler). The next section presents the methodological procedures of the present study.

3. Method

3.1 Participants

Two experimental groups were required to perform the tasks of the present study: one group of bilinguals (L2G), with Brazilian

Portuguese as the L1 and English as the L2, and one group of trilinguals (L3G), with Brazilian Portuguese as the L1, German as the L2 and English as the L3. A control group (L1G) formed by native speakers of English also took part in the present study.

In total, 44 participants[1] took part in the present study. However, due to technical problems during data collection, some data had to be disregarded[2]. The final sample of participants was 35: 13 participants for the L3 group, 11 for the L1G, and 11 for the L2G.

3.2 The experiment

Eye movements were registered (SMI 250 Hz) while participants performed a reading task, which was designed with the main goal of investigating how cognates among the participants' three languages (Brazilian Portuguese, German and English) influenced lexical access of the target language - English. Sentences were presented in a single line, font Monaco 26 and were formed with the cognate words and their matched controls (for further information see Appendix 1) as presented in Table 1.

Table 1 - Examples of experimental sentences.

Condition	Cognate	Control
Double cognate English-Brazilian-Portuguese	Mary said that the **actor** was happy with his career.	Mary said that the **clerk** was happy with his career.
Double cognate English-German	John thought that the **neighbor** was weird but intelligent.	John thought that the **employee** was weird but intelligent.

[1] All of the participants signed a consent form before agreeing to take part in the present study.

[2] Some problems that may cause difficulty in collecting precise eye-tracking data are related to the participants' vision. For instance, participants with high levels of astigmatism or that use reading glasses have problems to perform the calibration procedure. Apart from that, if there is any interruption of the eye-tracking experiment due to computer or electrical problems, the data may also need to be disregarded.

Triple cognate Brazilian-Portuguese-English-German	Kate said that the **author** was inspired by the new book.	Kate said that the **reader** was inspired by the new book.

Source: Own authorship.

There were 60 experimental sentences and 96 filler sentences in the experiment. Twenty-five percent (25%) of the sentences (both experimental and fillers) were followed by a comprehension question, in order to confirm that participants were devoting attention to the task being performed. For the comprehension questions, participants needed to answer *yes* or *no*, as in the following example:

Filler sentence: *The unexpected storm was not predicted in the forecast that we heard on the radio*

*C*omprehension question: *Was the storm predicted in the radio forecast?*

All of the sentences of the present study (experimental sentences and filler sentences) were submitted to a naturalness judgment test and to a predictability test. The following section presents the procedures adopted for data collection.

3.3 Procedures

Participants sat at a viewing distance of 50 to 60 cm of the monitor. Eye movements were recorded using an SMI Eye tracking system, running at 250Hz in the Language and Cogntive Processes Laboratory (LabLing), at the Federal University of Santa Catarina (UFSC). Viewing was binocular. However, eye movements were recorded only from the right eye. The entire experimental session lasted approximately 1h and it was divided into three blocks. The first block consisted of a training session. The other two blocks contained the experimental stimuli. The presentation of the experimental stimuli was divided into two blocks to avoid participants' exhaustion as an intervenient variable in the study. The next section presents the results obtained from the experiment carried out in the present study.

4. Results

The eye movements recorded were analyzed through the measures of first pass and first fixation. The measure of first pass consists of all of the forward fixations in the region of interest in the first time the reader lays his/her eyes in this region until the gaze moves either to the right or to the left of the region of interest. (Roberts & Siyanova-Chanturia). On the other hand, the measure of first fixation provides information about the duration of the first fixation in the region of interest. This measure can consist of a single fixation or multiple fixations (Roberts & Siyanova-Chanturia).

The independent variables of this experiment were of two types: group and cognate *status*. The independent variable *group* consisted of the L1G (control group, formed by native speakers of English), L2G (bilingual group, formed by speakers of Brazilian Portuguese (L1) and English (L2), and L3G (trilingual group, formed by speakers of Brazilian Portuguese (L1), German (L2) and English (L3). The independent variable *cognate status* consisted of the cognate types CGEP (double cognate English-Brazilian Portuguese), CGEG (double cognate English-German), and CGT (triple cognate English-German-Brazilian Portuguese) and their respective controls – CTEP (control of the double cognate English-Brazilian Portuguese), CTEG (control of the double cognate English-German), and CTT (control of the triple cognate English-German-Brazilian Portuguese). On the other hand, the dependent variables of this experiment were related to the measures of fixation time.

From the 44 participants that took part in the eye tracking experiment, 6 had to be excluded because they did not reach 90% of eye data registered; 3 were excluded due to lack of proficiency in either of the foreign languages, German or English. Thus, the final sample of participants for this experiment consisted of 35 participants: 11 of the L1G, 11 of the L2G, and 13 of the L3G. The mean accuracy of the participants in answering the comprehension questions ranged from 94 to 96%, showing that participants were engaged in the task being performed.

The measure of first pass is the most informative for the present study. Table 2 presents the results of mean fixation time for the measure of first pass for the three experimental conditions for the three groups of participants.

Table 2 - First pass for the conditions CGEP, CGEG and CGT for the three groups.

		CGEP	CTEP	CGEG	CTEG	CGT	CTT
L1G	**Mean**	234,08	214,57	223,73	235,30	204,40	211,80
	(SD)	(63,48)	(34,14)	(33,85)	(66,34)	(39,89)	(38,83)
	Median	223,20	205,30	234,44	252,80	205,54	218,20
	Minimum	147,9	171,6	173,8	121,13	140,27	136,70
	Maximum	348,3	277,4	288,78	353,90	251,64	276,20
L2G	**Mean**	325,27	383,68	385,20	367,52	382,01	394,03
	(SD)	(66,58)	(96,31)	(83,20)	(75,99)	(58,39)	(78,19)
	Median	344,40	346,40	414,30	353,55	347,45	397,00
	Minimum	197	277,1	265,22	220,40	310,27	238,60
	Maximum	427,6	599,3	507,11	467,5	487,45	536,70
L3G	**Mean**	354,14	385,97	393,79	385,76	407,51	448,22
	(SD)	(66,58)	(88,82)	(83,85)	(90,78)	(124,65)	(160,79)
	Median	359,20	354,60	384,44	372,60	374,90	445,90
	Minimum	206,6	259,2	267,00	274,88	228,73	260,40
	Maximum	462,5	547,7	544,56	582,60	647,64	864,80

Source: Own authorship.
N=35; L1G=11; L2G=11; L3G=13
Note: *N= number of participants; SD=Standard deviation*

Table 2 shows that, for the two conditions (CGEP and CTEP), for each group, the mean values of processing time for the measure of first pass were very similar indicating no difference between them. For the L1G there was a small difference of 20ms between conditions (234ms for CGEP, and 214ms for CTEP). For the L2G, the mean fixation time for the condition CGEP was 58ms shorter than for the control condition – CTEG. However, for the L3G

there was a shorter difference, the means were 354 and 385ms for the cognate and control conditions, respectively. In brief, these descriptive results indicate no difference between conditions CGEP and CTEP for the three groups.

Regarding the conditions CGEG and CTEG, Table 2 shows that the results of first pass seem to be very similar. For the L1G, the mean fixation time of the CTEG condition was only 12ms longer than for the CGEG condition. For the L2G, the mean fixation time for the CGEG condition was 18ms longer than the CTEG. For the L3G, the mean fixation time for the CGEG condition was only 8ms longer, on average, than the CTEG condition. These mean numbers show no difference between conditions, which means that there was no effect of the cognate condition CGEG for the three groups.

For the condition of triple cognates, CGT, Table 2 shows that for the L3G, the fixation time of the control condition was somewhat longer than that for the cognate condition (448ms for the CTT and 407ms for the CGT). These results might indicate some effect for this type of cognate. For the other groups, the results of the mean fixation time do not seem to indicate any difference between conditions. For the L1G, the mean fixation time for the condition of the CTT was only 7ms longer than for the CGT. For the L2G, the mean fixation time for the CTT condition was 12ms longer than the CGT.

In short, what can be initially argued from the results presented in Table 2 is that the L2G and the L3G had a similar behavior, since the differences between cognates and their respective controls do not seem to be large for all of the groups. Moreover, the reading time of the L1G is consistent with the literature, 200ms per word (Rayner). Nonnative speakers, on the other hand, took almost twice as much time to read the same words.

Next, Table 3 presents the results of the other measure chosen to be analyzed in the present study - first fixation. The results are presented for the conditions CGEP, CGEG and CGT for the three groups of participants.

Table 3 - First fixation for the conditions CGEP, CGEG and CGT for the three groups.

		CGEP	CTEP	CGEG	CTEG	CGT	CTT
L1G	**Mean**	215,73	194,62	195,31	212,50	178,88	187,50
	(SD)	(68,55)	(37,86)	(29,96)	(54,52)	(37,35)	(40,92)
	Median	217,00	194,80	190,20	228,80	176,18	185,00
	Minimum	117,10	139,00	135,90	96,90	119,27	136,70
	Maximum	348,30	258,70	237,90	280,90	238,27	276,20
L2G	**Mean**	256,32	291,20	286,66	287,30	303,01	284,52
	(SD)	(48,57)	(94,93)	(59,72)	(62,56)	(34,03)	(60,37)
	Median	256,50	256,30	313,80	279,50	296,63	286,40
	Minimum	196,90	211,80	199,10	212,40	252,45	202,60
	Maximum	319,80	520,60	370,20	411,60	360,90	418,30
L3G	**Mean**	265,52	284,59	291,37	289,84	264,88	311,30
	(SD)	(63,23)	(45,35)	(57,58)	(78,68)	(73,76)	(97,03)
	Median	244,50	278,10	293,66	261,00	234,36	270,20
	Minimum	182,20	208,20	183,66	191,50	173,90	205,00
	Maximum	375,80	357,50	400,00	467,70	416,36	503,90

Source: Own authorship.
N=35; L1G=11; L2G=11; L3G=13
Note: *N= number of participants; SD=Standard deviation*

Table 3 shows that, for the condition CGEP the mean values of fixation time for the L1G were 215ms for the CGEP and 194ms for the CTEP, indicating a difference of 21ms. For the L2G, the mean difference between conditions was 35ms, 256ms for the CGEP and 291ms for the CTEP. For the L3G, the mean values were 265ms for the CGEP and 284ms for the CTEP, which represents a difference of 19ms.

Regarding the results of the condition CGEG, Table 3 shows that the fixation time between conditions was equivalent for the

three groups. For the L1G, the mean fixation time was 195ms for the CGEG and 212ms for the CTEG, which represents a difference of 17ms. For the L2 and L3 groups there is practically no difference between conditions. The mean fixation time for the L2G was 286ms for the CGEG and 287ms for the CTEG. For the L3G the mean fixation time was 291ms for the CGEG and 289ms for the CTEG.

For the condition of CGT, it can be seen that for the L1G there was a very small difference of 9ms between the means (178ms for the CGT and 187ms for the CTT). For the L2G, there was a small difference of 19ms (303ms for the CGT and 284ms for the CTT). The L3G was the one that demonstrated the greatest difference between conditions; controls were fixated 47ms longer than cognates (264ms for CGT and 311ms for CTT).

To summarize, the information presented in Table 3 showed that the results of the measure of first fixation do not demonstrate a large difference between cognates and controls for any of the groups.

The results of the present study were also submitted to a statistical analysis of the data, where non-parametric tests were carried out. For each of the groups, a Wilcoxon test was carried out comparing the pairs of conditions CGEP-CTEP, CGEG-CTEG and CGT-CTT. In addition, a Mann-Whitney test was carried out in order to compare the groups in each cognate condition. Table 4 present the results of the statistical test for the measures of first pass and first fixation.

Table 4 - Results of Wilcoxon test for the measure of first fixation.

		First-pass			**First fixation**		
	Condition	CGEG-CTEG	CGEP-CTEP	CGT-CTT	CGEG-CTEG	CGEP-CTEP	CGT-CTT
L1G	Z	-0,533	-0,889	-0,800	-1,070	-1,245	-1,245
	Asymp.Sig. (2-tailed)	0,594	0,374	0,424	0,285	0,213	0,213
L2G	Z	-0,711	-1,423	-0,800	-0,178	-0,889	-1,156

	Asymp.Sig. (2-tailed)	0,477	0,155	0,424	0,859	0,374	0,248
L3G	Z	-0,314	-0,943	-1,922	-0,105	-1,363	-2,062
	Asymp.Sig. (2-tailed)	0,753	0,345	0,055*	0,917	0,173	0,039*

Source: Own authorship.
N=35; L1G = 11; L2G = 11; L3G = 13
*p<0,05
Note: N= number of participants

As can be seen in Table 4, the comparison of the mean fixation time for the measure of first pass for the conditions CGEG-CTEG, CGEP-CTEP, and CGT-CTT resulted in a significant difference only for the L3G for the condition of the CGT. This result favors the cognate facilitation effect, since processing time was shorter for the cognate word, as compared to its control.

Regarding the measure of first fixation, Table 4 shows that the comparison of the conditions CGEG-CTEG, CGEP-CTEP, and CGT-CTT was only significant for the L3G for the condition CGT. This result confirms the one obtained for the measure of first pass, also favoring the cognate facilitation effect. Next, Table 5 presents the results of the comparison of the three groups regarding each cognate condition CGEG, CGEP and CGT, for the measures of first pass and first fixation.

Table 5 - Results of Mann-Whitney for the measures of first pass and first fixation

		First-pass			**First fixation**		
Condition	Groups	L1G-L2G	L1G-L3G	L2-L3G	L1G-L2G	L1G-L3G	L2G-L3G
CGEG	Z	-3,842	-4,027	-0,029	-3,448	-3,564	-0,319
	Asymp.Sig. (2-tailed)	0,000*	0,000*	0,977	0,001*	0,000*	0,750
CGEP	Z	-2,791	-3,331	-1,072	-1,609	-1,825	-0,145
	Asymp.Sig. (2-tailed)	0,005*	0,001*	0,284	0,108	0,068	0,885

CGT	Z	-3,973	-3,911	-0,377	-3,973	-3,331	-2,115
	Asymp.Sig. (2-tailed)	0,000*	0,000*	0,706	0,000*	0,001*	0,034*

Source: Own authorship.
N=35; L1G = 11; L2G = 11; L3G = 13
*p<0,05
Note: N= number of participants

As can be seen in Table 5, for the measure of first pass, the comparison of the L1G with the other two groups was significant for all of the cognate conditions. This result confirms the difference observed in fixation time for native and nonnative speakers. As for the comparison of the L2 and L3 groups, no condition yielded a significant *p* value. This shows that the two groups had similar fixation time for the measure of first pass for the three cognate conditions.

Regarding the measure of first fixation, it can be seen in Table 5 that the comparison of the L1G with the other two groups yielded significant *p* values for the cognate conditions CGEG and CGT. Regarding the comparison of the results of the L2 and L3 groups, the only significant *p* value was for the cognate condition CGT. This result in is line with the one previously reported, regarding the significant difference of mean fixation time for the CGT condition as compared to the CTT condition for the L3G. The significant difference between the L2 and L3 groups confirms the facilitation effect of the triple cognate for the L3G.

In short, the results of the statistical analysis showed that the comparison of the conditions CGT-CTT was significant for the L3G for the measures of first pass and first fixation. The comparison of the results of the condition CGT between the groups L2 and L3 also yielded a significant *p* value ($p<0,05$). These results suggest an effect of the triple cognate in the comprehension of the sentences in English. Nevertheless, no significant effect of the double cognates was found in the present study for either of the groups. Additionally, the results of the measure of first fixation corroborate the ones found for the measure of first pass.

Finding no significant differences between conditions for the control group can be interpreted as evidence that the experiment was correctly designed. That is, equivalent processing time for cognates and controls for the L1G indicates no intervenient variable regarding the choice of the cognate-control pair. In addition, it is important to observe the significant difference between the L1 group (control) and the experimental groups. This shows that the experimental design was correct, since it is expected a faster processing time of native speakers as compared to non-native speakers. Another important result to be observed is the one related to the difference between cognates and controls: this difference favored the cognate facilitation effect. In other words, non-cognates have a higher processing cost. These results are further discussed in the next section.

5. Discussion

The results of the present study showed that the reading time of the native speakers was shorter than that of the nonnative speakers. The reading time of the L1G was consistent with the literature (Rayner) – approximately 200ms for the critical words. Nonnative speakers, on the other hand, took almost twice as much time to read the same words (300 to 400ms on average). This is evidence that the experiment was well designed since the native speakers of English read the cognate and control words, in 200ms, on average, which is indicated in the literature (Rayner). In addition, there seems to be no difference in any of the three conditions for the processing time of the cognate and control words for the control group. This also confirms the validity of the experiment, indicating the existence of no intervenient variable in the matching of the cognate-control pair of words.

Regarding the difference between conditions, the results demonstrated some effect for the triple cognate among German, English, and Brazilian Portuguese for the trilingual speakers ($p = 0{,}05$ for the measure of first pass, and $p = 0{,}03$ for the measure

of first fixation). This effect was evident in the shorter processing time of these cognates as compared to their respective controls in the measures of first pass and first fixation. These results suggest that the triple representation of the cognate word in the trilinguals' languages shortens the path to the lexical access of these words, and this is reflected in a shorter processing cost/time.

These results are in line with other studies reported in the literature, which also found evidence for the cognate facilitation effect (Lemhöfer, Dijkstra & Michel; Poarch & Van Hell; Dijkstra, Grainger & Van Heuven; Lemhöfer & Dijkstra; Schwartz & Kroll; Libben & Titone; Titone *et al.*; Van Assche, Duyck & Brysbaert; Cop *et al.*; Lauro & Schwartz; Vanlangendonck *et al.*).

The fact that for the L2G there were no significant differences between cognate and control for this specific condition (CGT) confirms that the results found are indeed the result of trilingualism and of the representation of this cognate word in the participants' three languages. Nevertheless, the present study failed to find a significant effect of the facilitation of double cognates (for each of the groups $p > 0,05$ for the comparison of mean fixation time between conditions CGEP and CTEP, and CGEG and CTEG). The results of the present study showed no difference between double cognates (CGEG and CGEP) and their respective controls, same result found by Yudes, Macizo and Bajo (2010) and Poort and Rodd (2019). However, this result does not disconfirm the hypothesis of the cognate facilitation effect, since the opposite effect was also not observed. That is, the comparison of the conditions CGEP-CTEP and CGEG-CTEG did not yield significant differences; controls were processed neither at a slower nor at a faster rate than cognates, for each of the three groups.

In addition, the results of the present study together with other studies (Titone *et al.*; Marian, Spivey & Hirsch) favor the view that even when the intention of the speaker is to use only one language, the lexicons of the other languages may be activated, causing some interference. The conclusions of the present study are presented in the next section.

6. Conclusion

In short, the results of the present study showed that there was an effect of the triple cognates for the L3G both for the measure of first pass and first fixation. On the other hand, the present study failed to find evidence favoring the cognate facilitation effect with the double cognates between Brazilian Portuguese and English and between German and English. In addition, the results favor the view that triple cognates have a stronger facilitative effect in the comprehension of English sentences.

Eye movements are a good measure to infer cognitive processing, mainly comprehension, as in the present study, since, according to Rayner, in more complex information processing tasks such as the ones involving sentence comprehension, the relationship between eye position and attention is very strong. However, at the same time, the measure provided by the eye movement recording technique is a very sensitive one. Therefore, one explanation that might be offered for the results of the present study is that the effect of double cognates was not strong enough to be demonstrated in this measure for such a small sample of participants.

We can hypothesize that the triple cognates, having representations in the trilinguals' three languages, have a stronger facilitation effect than the double cognates, which was demonstrated in the present study. However, it cannot be stated that the double cognates have no facilitation effect.

In short, it can be stated that the results of this experiment contribute to the literature on lexical access and multilingualism. The results of the triple cognates suggest that lexical access is not restricted to the target language, contradicting the hypothesis that in sentence context lexical access would be restricted only to the target language, which in the case of the present study is English. Therefore, the results of this experiment favor the hypothesis of language non-selectivity, where all the languages of the trilingual are activated and compete for selection.

References

Chambers, Craig G.; Cooke, Hilary. "Lexical competition during second-language listening: Sentence context, but not proficiency, constrains interference from the native lexicon". *Journal of Experimental Psychology: Learning, Memory, and Cognition*. 35.4, (2009): 1029.

Cop, Uschi; *et al*. "Reading a book in one or two languages? An eye movement study of cognate facilitation in L1 and L2 reading". *Bilingualism: Language and Cognition*. 20.4, (2017): 747-769.

Dijkstra, Ton; *et al*. "Multilink: a computational model for bilingual word recognition and word translation". *Bilingualism: Language and Cognition*. 22.4, (2019): 657-679.

Dijkstra, Ton. "Bilingual visual word recognition and lexical access". *Handbook of bilingualism: Psycholinguistic approaches,* Kroll, Judith F. and Annette MB De Groot, (Eds.). Oxford: University Press, 2005, pp. 179-201.

Dijkstra, Ton; Grainger, Jonathan; Heuven, Walter JB Van. "Recognition of cognates and interlingual homographs: The neglected role of phonology". *Journal of Memory and language*. 41.4, (1999): 496-518.

Dijkstra, Ton; Heuven, Walter JB Van. "The architecture of the bilingual word recognition system: From identification to decision". *Bilingualism: Language and cognition*. 5.3, (2002): 175-197.

Duñabeitia, Jon Andoni; *et al*. "Electrophysiological correlates of the masked translation priming effect with highly proficient simultaneous bilinguals". *Brain research*. 1359, (2010): 142-154.

Hoversten, Liv J.; Traxler, Matthew J. "A time course analysis of interlingual homograph processing: Evidence from eye movements". *Bilingualism: Language and Cognition*. 19.2, (2016): 347-360.

Jared, Debra; Kroll, Judith F. "Do bilinguals activate phonological representations in one or both of their languages when naming words?". *Journal of memory and language*. 44.1, (2001): 2-31.

Kerkhofs, Roel; *et al*. "Testing a model for bilingual semantic priming with interlingual homographs: RT and N400 effects". *Brain research*. 1068.1, (2006): 170-183.

Kroll, Judith F.; Stewart, Erika. "Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations". *Journal of memory and language*. 33.2, (1994): 149.

Lauro, Justin; Schwartz, Ana I. "Cognate effects on anaphor processing". *Journal of Experimental Psychology: Learning, Memory, and Cognition*. 45.3, (2019): 381.

Lemhöfer, Kristin; Dijkstra, Ton. "Recognizing cognates and interlingual homographs: Effects of code similarity in language-specific and generalized lexical decision". *Memory & Cognition*. 32.4, (2004): 533-550.

Lemhöfer, Kristin; Dijkstra, Ton; Michel, Marije. "Three languages, one ECHO: Cognate effects in trilingual word recognition". *Language and cognitive processes*. 19.5, (2004): 585-611.

Libben, Maya R.; Titone, Debra A. "Bilingual lexical access in context: evidence from eye movements during reading". *Journal of Experimental Psychology: Learning, memory, and cognition*. 35.2, (2009): 381.

Marian, Viorica; Spivey, Michael; Hirsch, Joy. "Shared and separate systems in bilingual language processing: Converging evidence from eyetracking and brain imaging". *Brain and language*. 86.1, (2003): 70-82.

Perea, Manuel; Dunabeitia, Jon Andoni; Carreiras, Manuel. "Masked associative/ semantic priming effects across languages with highly proficient bilinguals". *Journal of Memory and Language*. 58.4, (2008): 916-930.

Poarch, Gregory J.; Van Hell, Janet G. "Cross-language activation in children's speech production: Evidence from second language learners, bilinguals, and trilinguals". *Journal of Experimental Child Psychology*. 111.3, (2012): 419-438.

Poort, Eva D.; Rodd, Jennifer M. "Towards a distributed connectionist account of cognates and interlingual homographs: Evidence from semantic relatedness tasks". *PeerJ* 7. (2019): 6725.

Rayner, Keith. "Eye movements in reading and information processing: 20 years of research". *Psychological bulletin*. 124.3, (1998): 372-422.

Reichle, Erik D. "Serial-attention models of reading". *The Oxford handbook of eye movements,* Liversedge, Simon; Iain Gilchrist and Stefan Everling. (Eds.). Oxford: University Press, 2011, pp. 767-786.

Roberts, Leah; Siyanova-Chanturia, Anna. "Using eye-tracking to investigate topics in L2 acquisition and L2 processing". *Studies in Second Language Acquisition*. 35.2, (2013): 213-235.

Schwartz, Ana I.; Kroll, Judith F. "Bilingual lexical activation in sentence context". *Journal of memory and language*. 55.2, (2006): 197-212.

Sunderman, Gretchen; Kroll, Judith F. "First language activation during second language lexical processing: An investigation of lexical form, meaning, and grammatical class". *Studies in second language acquisition*. 28.3, (2006): 387-422.

Szubko-Sitarek, Weronika. *Multilingual lexical recognition in the mental lexicon of third language users*. Heidelberg: Springer, 2015.

Telstad, Siri. *Investigating potential L3 cognate facilitation effects on L2-A study of Spanish-English cognates in L1 speakers of Norwegian*. MS thesis. NTNU, 2018.

Titone, Debra; *et al*. "Bilingual lexical access during L1 sentence reading: The effects of L2 knowledge, semantic constraint, and L1–L2 intermixing". *Journal of Experimental Psychology: Learning, Memory, and Cognition*. 37.6, (2011): 1412.

Van Assche, Eva; Duyck, Wouter; Brysbaert, Marc. "Verb processing by bilinguals in sentence contexts: The effect of cognate status and verb tense". *Studies in Second Language Acquisition*. 35.2, (2013): 237-259.

Vanlangendonck, Flora; *et al*. "Mixing the stimulus list in bilingual lexical decision turns cognate facilitation effects into mirrored inhibition effects". *Bilingualism: Language and Cognition*. (2020): 1-9.

Yip, Michael CW; Zhai, Mingjun. "Processing Homophones Interactively: Evidence from eye-movement data". *Scientific reports*. 8.1, (2018): 1-11.

Yudes, Carolina; Macizo, Pedro; Bajo, Teresa. "Cognate effects in bilingual language comprehension tasks". *NeuroReport*. 21.7, (2010): 507-512.

Zhu, Yanjiao; Mok, Peggy Pik Ki. "Visual recognition of cognates and interlingual homographs in two non-native languages: Evidence from Asian adult trilinguals". *Linguistic Approaches to Bilingualism*. (2019).

Recebido em: 15/08/2020
Aceito em: 17/10/2020
Publicado em dezembro de 2020

Pâmela Freitas Pereira Toassi. E-mail: pamelatoassi.ufc@gmail.com. ORCID: https://orcid.org/0000-0003-3273-639X
Mailce Borges Mota. E-mail: mailcemota54@gmail.com. ORCID: https://orcid.org/0000-0002-8674-2480
Elisângela Nogueira Teixeira. E-mail: elisteixeira@letras.ufc.br. ORCID: https://orcid.org/0000-0003-3924-3985

APPENDIX 1

The 60 cognates and their respective controls.

Condition	Cognate	Control	Condition	Cognate	Control	Condition	Cognate	Control
CGEP	actor	clerk	CGEG	corn	meat	CGT	inspector	physician
CGEP	cereal	pepper	CGEG	fish	bird	CGT	tractor	nursery
CGEP	error	laugh	CGEG	butter	candle	CGT	insect	potato
CGEP	piano	bench	CGEG	beer	meal	CGT	academy	lecture
CGEP	dentist	surgeon	CGEG	knee	bone	CGT	fantasy	holiday
CGEP	accident	basement	CGEG	magazine	workshop	CGT	camera	ladder
CGEP	fruit	candy	CGEG	neighbor	employee	CGT	author	reader
CGEP	desert	jungle	CGEG	affair	injury	CGT	tourist	emperor
CGEP	discount	salesman	CGEG	ending	screen	CGT	restaurant	enterprise
CGEP	suggestion	assumption	CGEG	engagement	commitment	CGT	guitar	mirror
CGEP	poet	file	CGEG	cousin	player	CGT	professor	painting
CGEP	favor	break	CGEG	summer	spring	CGT	plant	horse

CGEP	funds	trust	CGEG	friend	couple	CGT	object	speech
CGEP	exercise	fighting	CGEG	bear	hole	CGT	project	chapter
CGEP	color	price	CGEG	nose	foot	CGT	quality	freedom
CGEP	success	failure	CGEG	wine	tree	CGT	theme	depth
CGEP	decision	marriage	CGEG	wind	snow	CGT	phase	score
CGEP	test	bill	CGEG	brother	teacher	CGT	model	frame
CGEP	conclusion	assignment	CGEG	wagon	chair	CGT	student	husband
CGEP	member	letter	CGEG	scene	judge	CGT	director	security