The Cognate Boost: A Study of Picture Naming across Proficiency Levels with L2 Learners of Russian*

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Abstract: The purpose of this study was to investigate the "cognate boost" in Russian. Based on the Revised Hierarchical Model of bilingual memory and the theory of nonselective language storage in bilinguals, it was assumed that cognates would facilitate the performance of L1 English learners of L2 Russian in a picture-naming task, though this effect would be modulated by proficiency level. Twenty-two college-level learners of Russian from two proficiency levels were asked to complete a picture-naming task in Russian. Half performed a task with cognates present and half without. An analysis of response time and accuracy showed that cognates facilitate the performance of lower proficiency speakers, while higher proficiency speakers are not affected. These results support the theories mentioned previously and show a cognate effect despite the differing orthographies of English and Russian. This paper presents the results of the quantitative and qualitative analyses and their implications for theories of language acquisition and storage.

1. Introduction

Cognates are "words that are orthographically, phonologically, and semantically similar (to some degree)" (Altarriba and Basnight-Brown 2009: 91). Previous studies have explored the effect of cognates on picture naming in various languages, and a cognate advantage has been found to stem from phonology and semantics (Blumenfeld and Marian 2007; Fox 1996) and despite orthographic differences (Hoshino and Kroll 2008). In this study cognates are defined as lexical items that share

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conceptual units and phonological form in more than one language (see section 3.2 for examples). Parallel and simultaneous language activation of both languages in bilinguals[1] has also been shown to occur in picture-naming tasks (Altarriba and Basnight-Brown 2009). Based on these findings and on the Revised Hierarchical Model of bilingual memory (Kroll and Stewart 1994), it is assumed that a cognate boost, or a boost in the performance of participants driven by the presence of cognates in a task, may differ according to the learner's second language (L2) proficiency level.

The goal of this study was to determine the effects of lexical status on response time and accuracy for L1 English learners of L2 Russian in an L2-only picture-naming task. There have been many studies on cognates and their effect on bilingual and L2 learner production and comprehension in the field of psycholinguistics (Bates et al. 2003; Costa, Santesteban, and Caño 2005; Hoshino and Kroll 2008; Lemhofer and Dijkstra 2004; Schwartz and Areas da Luz Fontes 2008; etc.). This study contributes a new group of participants, L2 Russian learners at two proficiency levels, allowing a new look at cognates across different proficiency levels and orthographies.

2. Literature Review

The existence of the cognate boost is inherently tied to the fact that a bilingual's or L2 learner's cognitive structure must somehow store necessary information (lexical, phonological, semantic, etc.) for two languages (de Groot 2011), as well as activate that information appropriately in the process of using language. As in monolinguals, bilingual or L2 learner memory is split according to timescale into short-term memory (STM) and long-term memory (LTM) (Bartolotti and Marian

[1] As one reviewer noted, the term "bilingual" is used inconsistently in the field. It may be used to refer to speakers who speak two languages from birth or to speakers who learn a second language as a child or as an adult to varying levels of proficiency. In this study, the participants are L1 English speakers who were in the process of learning Russian in college at the time of the study. Many of the studies cited in the literature review also looked at adult learners or at bilinguals who were not "balanced" but very proficient. Many still referred to them as bilinguals. For this reason, throughout the literature review I use the term bilingual, though the participants in this study may not be considered bilinguals by all who use that term. The fact remains that the cognitive issues of storage and language use discussed below are relevant to bilinguals at all levels of proficiency because of the involvement of the second language in cognition.

2012; de Groot 2011: ch. 3). LTM is made up of explicit memory (facts and events) and implicit memory (for skills, routines, and associations) (Bartolotti and Marian 2012). Explicit memory is further divided into two types: semantic, for general facts and word-meaning connections, and episodic, for events and the linguistic environment in which they occurred (Bartolotti and Marian 2012).

Semantic memory is where concepts are stored. It is generally agreed that this storage is language independent, or not tied to either of a bilingual's two (or more) languages (Fox 1996; Kroll, Bobb, and Wodniecka 2006; Szmalec et al. 2012). This is sometimes referred to as the language independent, or language non-specific hypothesis. Language use requires activation and deactivation of these representations in memory as necessary for communication or processing (de Groot 2011). There is no agreement on where linguistic information becomes attached to concepts in the process of activation. Some argue against any single locus of selection because of the many variables that can influence language selection (Kroll, Bobb, and Wodniecka 2006) and because both of a bilingual's or L2 learner's languages are activated at any given time to differing degrees (Grosjean 2004). Therefore, linguistic information (i.e., orthography, phonology, etc.) is stored separately from conceptual information.

Overall, Kroll, Bobb, and Wodniecka (2006) argue that the bilingual cognitive system is fundamentally non-selective at all levels as far as language is concerned, and that in the process of memory retrieval language will be assigned or chosen as necessary (in both comprehension and production). This is supported by evidence for the theory of parallel spreading activation, advanced by Collins and Loftus (1975), which states that stored items or representations will activate other related items to which they are somehow linked. Both semantic and linguistic links can cause this type of spreading across a bilingual's languages.[2] Proficiency level may also be relevant, as acquisition of L2-specific concepts has been shown to alter the cognitive memory structure (including storage of concepts) of a bilingual in a way that differs from that of a monolingual (Athanasopoulos 2007).

[2] This theory is in line with the structure of the popular BIA+ model of bilingual visual word recognition, which posits a single store of lanugage organized by a computational tagging system (van Heuven and Dijkstra 2010).

2.1. Conceptual Overlap and the Cognate Boost

The idea of a "cognate boost," or an increase in language activation, for bilinguals and for L2 learners has been established in previous studies for word recognition (Blumenfeld and Marian 2007) and word production (Costa, Santesteban, and Caño 2005). As stated by van Hell and de Groot (1998), cognates seem to have a conceptual representation that differs from other word types; in fact, they may share more "conceptual units" in the semantic store in LTM (van Hell and de Groot 1998: 208). In their study, a picture recognition task using eye-tracking equipment, Blumenfeld and Marian (2007) found that the presence of cognates was sufficient to boost coactivation and speed in performance for lower proficiency level speakers, but that it was less likely to affect decision level processing (Blumenfeld and Marian 2007). They concluded that their results with cognates support high interactivity between languages during processing, especially for lower proficiency participants.

This high interactivity between languages supports the view of bilingual cognition as language nonspecific (Kroll, Bobb, and Wodniecka 2006), as well as the Revised Hierarchical Model (RHM)[3] of bilingual memory (Kroll and Stewart 1994). The RHM is presented in Figure 1 and is explained below. This model presupposes a common conceptual store and interaction between a bilingual's two languages in the process of bilingual language access. Semantic representations are shared in LTM, while lexical representations are separate.

While the RHM has been shown to have some weaknesses,[4] it also has many strengths. In the RHM, there is a strong lexical link between the L2 and the first language (L1) in the early stages of L2 learning. In other words, at lower proficiency levels, L2 learners will rely on their L1-to-concept connections for access. However, with increasing proficiency, the speaker will also develop stronger direct links from the L2 lexical store to the concept store, allowing for less dependency on the L1.

[3] The cognate boost also supports other prominent models, including the BIA+ model (van Heuven and Dijkstra 2010). As this model focuses on visual word recognition, it is not relevant to the current study, in which orthography is not present.

[4] Arguments leveled against the RHM include: lack of evidence for separate lexicons, issues with language selective access, and stronger initial connections between the L2 and the concept store than the RHM supposes. Brysbaert and Duyck (2010) also make a case for incorporating both language-dependent and language-independent ideas into a system of cognition. Proponents of this argument prefer a computational approach, as they say it is more robust in the face of these issues.

A strength of the RHM is that "it attempts to explain how one becomes bilingual" in the process of learning the L2 (Altarriba and Basnight-Brown 2007: 94). It allows for the study of the process of acquisition rather than focusing on the "final" state of proficiency (which may not exist). While this view of two separate and distinct lexicons has become less popular, the idea that L2-based links and connections to semantic memory in LTM increase in number and become stronger with increases in proficiency level is more widely accepted.

2.2. Bilingual Language Activation

While the intention to express an idea or to name a pictured object in a specific language should be under the control of the speaker, at least enough to restrict the activation to the intended language only, previous studies have shown that in reality this is usually not the case (Hoshino and Kroll 2008; Kroll, Bobb, and Wodniecka 2006; van Heuven, Schriefers, Dijkstra, and Hagoort 2008). Both of a bilingual's or L2 learner's languages are always activated to some degree (Grosjean 2004), allowing competition between items across languages in activation and production (de Groot 2011).

For higher proficiency speakers, intention to speak in one language alone may sometimes suffice due to their mastery of language modes

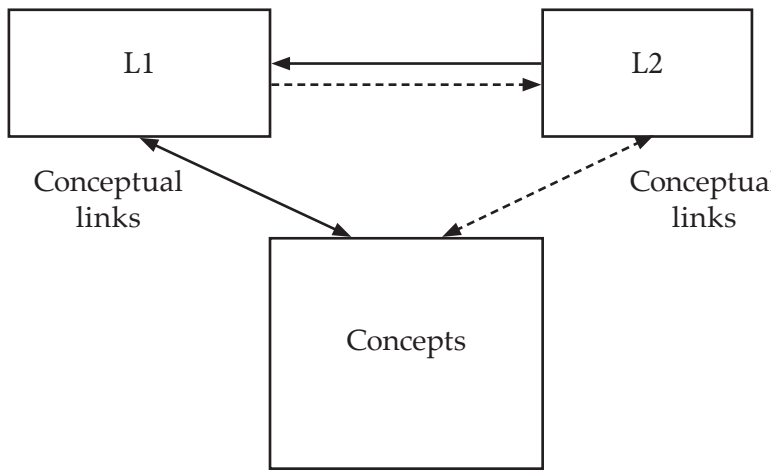

Figure 1. The Revised Hierarchical Model, as depicted in Kroll and Stewart 1994.

and code switching (van Heuven et al. 2008; van Heuven and Dijkstra 2010). However, for the majority of speakers, interaction between and across languages can occur at all levels of bilingual activation, and this interaction is not entirely in the control of the speakers. The cognate boost, because it results from a connection between languages that is driven by conceptual overlap in LTM, supports continual interaction between and simultaneous activation of both of a bilingual's languages. This is due to the fact that the boost relies on the existence of connections between L1 and L2 information for one concept.

2.3. Orthography

While cognates are often defined as sharing concepts, phonology, and orthography, they also exist in languages that do not share orthographies. In their study, Hoshino and Kroll (2008) examined the role of orthography in a bilingual picture-naming task. Because previous research suggests that all lexical codes and levels are active to some degree despite the specific requirements of a given task, it is possible that differing orthographies could impact both the amount of cross-linguistic activation and the presence of the cognate boost. They concluded that even when two languages do not share the same script (in their case, Japanese and English), phonological activation of the non-target language occurs. They also found cognate facilitation despite different scripts, concluding that a different orthography will only have an inhibitory effect when script is present. In this study, the fact that Russian and English have different scripts was not expected to have an inhibitory effect on the participants' performance as the orthographies would not be present.

2.4. Predictions and Previous Research

In this study the participants were beginning and intermediate learners of Russian. The prediction that a beginning speaker will show increased activation (and therefore, speed and accuracy) when cognates are presented is based on the idea that low-proficiency speakers are still reliant on their L1 (English) for access to the concept store, as shown in the RHM. The connection from the L2 to the L1 should thus be boosted by the cognates, which speed up the connection and facilitate access to the concept store via existing L1-to-concept connections. Advanced speakers, however, should have a more direct link from the L2 to the

concept store; either cognates will distract them and cause interference (due to the fact that the connection to the L1 is unnecessary for these speakers, and the cognates will force them to activate the L1 more than they would otherwise), or there will be no effect. These predictions are based on both the RHM and accepted views of bilingual- and L2-learner memory structure (Bartolotti and Marian 2012; de Groot 2011).

3. The Study

The purpose of this experimental study was to answer the following question: Does the presence of cognates in a picture-naming task affect the performance (e.g., reaction time and accuracy) of Russian-language learners across proficiency levels? The effect of lexical status on lexical activation (of Russian and English) across two proficiency levels was examined during a bilingual picture-naming task. It was predicted that cognates would boost the activation of Russian for lower proficiency speakers (second-year Russian) and inhibit it or have no effect for higher proficiency speakers (fourth- and fifth-year Russian). The latter is based on the changing cognitive structure of bilinguals as proficiency increases according to the RHM, as discussed above. When cognates are present, lower-proficiency speakers of Russian will show a decrease in reaction time and an increase in accuracy, while higher-proficiency speakers will either show an increase in reaction time, a decrease in accuracy, or no effect at all.

3.1. Participants

The participants included 22 college students of Russian as a foreign language at an American university.[5] All were native speakers of English. There were an equal number of male and female participants, and the average age was mid-20s. Few of the participants had studied abroad, and few used Russian in any manner outside of class time and studying. In the second-year group, all had completed at least three quarters of Russian. In the fourth- and fifth-year group, the number of years of studying Russian was more varied, but all were in the same

[5] Altogether, there were 26 participants, but the results of only 22 were used in the final analysis. The results of two of the original participants were not analyzed due to technical errors, and those of two others because they were heritage speakers of a language other than English. The technical errors were due to issues with SuperLab, and not related to the performance of the participants.

fourth- and fifth-year courses at the time of the experiment. Because the participants were enrolled together in the same courses and therefore received the same amount of input in Russian, they were considered to be at one proficiency level for this study. The participants' university uses ACTFL[6] proficiency guidelines to inform course placement. All of the participants reported receiving scores of B or higher in their Russian courses. In order to avoid confounding variables, a qualitative and quantitative analysis of the information provided by the background questionnaires was performed.

3.2. Materials

The materials consisted of a series of images used in the picture-naming task and a questionnaire. The images were taken from the bank of approved black and white images for psychological and psycholinguistic testing provided by the International Picture Naming Project.[7] Each list consisted of 74 images. For the noncognate list, all of the images were noncognates. For the cognate list, 30 cognate images replaced 30 noncognate images, while the remaining images were the same as those in the first list. None of the images were distracting or confusing for enough of the participants to warrant being excluded in the analysis.

The 30 noncognate images in the control condition (which were replaced in the experimental condition with cognate images) match the cognate words for frequency level in Russian. For the purposes of this task, two words are defined as "matching" by frequency if their frequencies are within 100 instances per million (ipm) of each other (Zosorina 1977). However, it must be noted that a "frequent" word according to a frequency dictionary for native speakers of Russian may be very different from words that L2-learners encounter "frequently." All words (and therefore images) were chosen from the textbooks (Lubensky et al. 2002) used for the first-year and part of the second year of instruction in Russian at the university attended by the participants. Because a student's internal corpus of Russian is different from that of a

[6] For more information on ACTFL guidelines, see http://www.actfl.org.

[7] The pictures were selected from a standardized set of 520 pictures used in the International Picture Naming Project (IPNP) and available for download at http://crl.ucsd.edu/~aszekely/ipnp/1stimuli.html.

native speaker, the words used in the textbooks for a beginning student would likely be more frequent for them.

For the purposes of this study, cognates are defined as words sharing conceptual units and phonological form in more than one language. Noncognates include words that "may have the same or similar meanings but differ in terms of orthography and phonology" as well as words that do not have similar meanings. These definitions are commonly used for psycholinguistic studies of this nature.[8] Some examples of the cognates used in this study are included in Table 1.

The background questionnaire included questions about when the participants began studying Russian, whether they had studied abroad, their average grades in Russian courses, in what contexts they used Russian, and the amount of time per week they dedicated to Russian on average.

Table 1. Examples of cognates used in the study[9]

Russian	Transliteration	English	Image
сигарета	*sigareta*	cigarette	
тостер	*toster*	toaster	
джинсы	*džinsy*	jeans	

3.3. Procedure

The study followed a cross-sectional 2x2 design (two proficiency levels and two task conditions). The participants were split into two groups at each proficiency level, with two variations of the same picture-naming task, and were required to name images on the computer screen in Russian in the program SuperLab. At each proficiency level there was a control group (who completed a picture-naming task with

[8] The orthographic form of the words was not used in the study.

[9] The entire list can be found in the appendix.

no cognates present among the images) and an experimental group (who completed a task with cognates present). Each participant was tested individually in a laboratory setting.

The task required the participants to name the image on the screen and simultaneously press a key to move on to the next image. For each participant, the images were presented on the computer screen in the same, semi-randomized order. Words that were semantically related, with similar meanings, or that rhymed, were not placed within two to three images of each other in either list. The reaction time of the participants was measured using the program SuperLab 4. Before the experimental stage of the study began, the images were checked for comprehensibility and clarity with a group of English speakers. Some of the data initially collected were discarded due to technical errors in the performance of the participants. For example, one participant did not keep her hand near the button. Her response time scores are therefore inconsistent. In all, two participants' results were discarded for this reason.[10]

After filling in the background questionnaire, the participants were given instructions in English about the task. They were instructed to avoid making distracting noises, speaking in English, or spending too long on any one image, though they were allowed to skip images if they did not remember the name of the item. Their voices were also recorded in the program GarageBand in order to analyze accuracy (though not voice onset), and notes were taken by the researcher after completion of the task. Before the start of the task, a series of two trial images was shown to allow them time to adjust to the task's requirements. The participants each received two points of extra credit on their next exam in their Russian course for participation in the study.

4. Data Analysis and Results

The independent variables in this study were proficiency level and presence of cognates. The dependent variables were reaction time and accuracy. The presence of cognates and proficiency level were between-subject variables. Recorded responses were coded for accu-

[10] It is because of this and because of the other reasons stated above (e.g., heritage speakers) that the groups at each proficiency level were not the same size (second-year split into two groups of seven and eight participants; fourth- and fifth-year split into two groups of five and three participants). These issues arose after the data-collection stage and did not negatively impact the analysis.

racy. Responses that deviated from the expected response,[11] responses that started with a hesitation, and null responses (i.e., no response) were scored as errors following standard analysis of this task in the field. If the participant corrected himself or herself after pressing the response key, the following response was coded as an error and excluded from the quantitative data analysis; however, these responses were taken into account in the qualitative data analysis. All analyses were completed in the program R.[12]

For latency data, a linear mixed-effects model (Baayen, Davidson, and Bates 2008) was fit to the data, both between conditions and within the cognate condition at both proficiency levels. Between conditions, "task" indicates whether the participant performed the cognate or non-cognate task. Within the cognate condition, "after" indicates words that came after cognates in the task; this was included to determine whether cognates had a significant effect on the activation of items that followed them. The structure of the model for each condition is given in Table 2 on pages 296–<<13>>, as well as the output, which is discussed in section 4.1. Fixed effects from the questionnaires were also included: whether the participant had studied abroad ("study abroad"); the average grade the participant had received in Russian courses ("grades"); the time per week the participant reported spending on Russian outside of class ("hours"); and whether or not the participant was exposed to Russian outside of class ("exposure"). The participants were also asked if they had studied another language. Since they all had, the category was ultimately split between Indo-European languages and non-Indo-European languages ("language").

In order to analyze accuracy, a logistic mixed-effects model (Jaeger 2008) was fit to the data both between conditions and, within the cognate condition, between proficiency levels. The model structure for each condition is given in Table 3 (on pages 300–301), as well as the output, which is discussed in section 4. Fixed effects taken from the questionnaires are also included in the accuracy analysis, as can be seen in Table 3. Mixed-effects models are the optimal way to analyze these data, because they allow for the analysis of random effects of multiple variables at once and they are robust in the face of missing data (Baayen, Davidson, and Bates 2008).

[11] In some cases, more than one answer was expected, i.e., "girl" or "woman" for an image of a female person.

[12] For more information, see http://www.r-project.org/.

Table 2. Linear mixed-effects models fit to latency data

Model	Fixed Effects	Estimate	Standard Error	*t*-value	Random effects	Variance	Standard Deviation
A: *RT between both years and tasks*	Intercept	8.159	0.117	**69.56***	Word	0.022	0.148
	Year	–0.330	0.234	1.41	Subject	0.039	0.197
	Task	–0.146	0.134	1.09	Residual	0.094	0.307
	Language	0.119	0.189	0.61			
	Exposure	0.054	0.095	0.57			
	Hours	0.001	0.009	0.13			
	Grades	–0.060	0.142	0.42			
	Study Abroad	0.008	0.191	0.04			
	Year: Task	–0.071	0.207	0.34			

B: *RT within cognate task, between years*	Intercept	8.155	0.097	**83.86***	Word	0.013	0.114
	Year	–0.500	0.272	1.84	Subject	0.028	0.168
	Cognate	–0.203	0.058	**3.50***			
	After	–0.060	0.060	1.01			
	Language	0.125	0.307	0.41			
	Exposure	–0.107	0.174	0.61			
	Hours	0.001	0.017	0.08			
	Grades	0.189	0.245	0.77			
	Year: Cognate	0.134	0.073	1.84			
	Year: After	0.034	0.077	0.44			

A and B give the output of the linear mixed-effects models fit to the log-transformed latency data for both years across tasks (A) and within the cognate task (B). Significant effects are marked with *. Model fit statistics are as follows: A (AIC = 569.5, BIC = 626.0, log-likelihood = –272.7), B (AIC = 204.1, BIC = 256.2, log-likelihood = –89.1). It must be acknowledged that these model-fit statistics are low. Intercept values are as follows: A (second-year, noncognate task, Indo-European language, less exposure to Russian outside of class, median of hours spent studying, better grades, no study abroad), B (second-year, noncognate item, item not following a cognate, Indo-European language, less exposure to Russian outside of class, median of hours spent studying, better grades).

4.1. Quantitative Results

The quantitative and qualitative results of the study are discussed below. First, the linear and logistic mixed-effects models that were fit to the latency accuracy data are discussed, followed by a description of the results for each both within condition and between conditions. The qualitative results from the questionnaires are discussed in section 4.2.

4.1.1. Results for Reaction Time

A linear mixed-effects model was fit to the latency data for both conditions at both proficiency levels in R. As shown in Table 2 (A), there were no significant effects found in this model. A linear mixed-effects model was also fit to the latency data within the cognate condition and between proficiency levels in R. As shown in Table 2 (B), the presence of cognates significantly affected the second-year students' reaction time (B, Cognate: B = –0.203, t = 3.50). In fact, they were significantly faster when responding to the cognate trials than the noncognate trials. The reaction time of the fourth- and fifth-year students was not significantly impacted by any of the fixed effects (Table 2: A and B, see fixed effects for Year and the interaction of Year with other effects).

4.1.2. Results for Accuracy

A logistic mixed-effects model was fit to the accuracy data between conditions at both proficiency levels in R. As shown in Table 3 (A), none of the fixed effects significantly affected the accuracy of the second-year or fourth-year participants in the between-group analysis. However, within the cognate condition (Table 3, B), there were significant effects of proficiency level (B, Year: B = 0.437, z = 2.470, p <0.05) and previous languages studied (B, Language: B = –1.127, z = 2.012, p <0.05). In other words, the fourth-year participants were significantly more accurate overall than the second-year participants for the cognate task. Both groups were also significantly more accurate in the cognate condition when they had studied an Indo-European language previously.

4.1.3. Summary of Quantitative Results

Within the cognate condition, second-year participants were significantly faster when responding to a cognate item than to a noncognate item. No significant effects on the reaction time of the second-year or fourth-year students were found in the analysis between conditions. Within the cognate condition, fourth-year students were significantly more accurate overall as compared to the second-year participants. Those participants who had previously studied another Indo-European language were also significantly more accurate in the cognate condition.

4.2. Qualitative Assessment of Questionnaires and Responses

The information given in the participants' questionnaires and their responses to the items used in the tasks was analyzed qualitatively. Overall the group was fairly demographically homogenous. Only two participants were not in the age range of 18–26; both were in their 30s. All of the participants were enrolled in Russian courses at the time of the study.

The average total amount of the participants' time studying Russian was 2.11 years. However, the average amount of continuous study was 1.75 years. Three participants had breaks (i.e., significant periods of more than one year) in their period of studying Russian, though this did not significantly affect their performance. Study abroad was not something the majority had experienced, and the only participants who had studied abroad were at the fourth-year proficiency level. As can be seen in the quantitative results, study abroad did not have a significant effect on reaction time or accuracy. The length of study abroad was most commonly two months, but one participant in the fourth-year noncognate group had studied abroad for five months.

The average grades of the participants were included in the quantitative analysis. All had received one of four grades: A, A–, B+, or B. Generally, the grades of the fourth-year group were higher. Eight participants, or 36.36%, had A averages; the same number had A– averages. Three participants, or 13.63%, had either B+ averages and B averages.

Table 3. Logistic mixed-effects models fit to accuracy data

Model	Fixed Effects	Estimate	Standard Error	*z*-value	*p*-value	Random effects	Variance	Standard Deviation
A: *Accuracy between both years and tasks*	Intercept	–0.524	0.353	1.484	> 0.05	Word	1.589	1.261
	Year	–1.038	0.667	1.555	> 0.05	Subject	0.258	0.507
	Task	–0.104	0.385	0.270	> 0.05			
	Language	–0.733	0.537	1.363	> 0.05			
	Exposure	–0.496	0.268	1.854	> 0.05			
	Hours	0.008	0.025	0.307	> 0.05			
	Grades	–0.441	0.403	1.093	> 0.05			
	Study Abroad	0.559	0.544	1.027	> 0.05			
	Year: Task	–0.037	0.589	0.062	> 0.05			

B: *Accuracy within cognate task, between years*	Intercept	–0.475	0.357	1.329	> 0.05	Word	1.637	1.280
	Year	1.437	0.582	2.470	**< 0.05***	Subject	0.021	0.145
	Cognate	0.763	0.455	1.680	> 0.05			
	After	0.165	0.452	0.364	> 0.05			
	Language	–1.127	0.560	2.012	**< 0.05***			
	Exposure	0.431	0.302	1.424	> 0.05			
	Hours	–0.033	0.030	1.098	> 0.05			
	Grades	–0.060	0.475	0.126	> 0.05			
	Year: Cognate	–0.018	0.509	0.035	> 0.05			
	Year: After	–0.706	0.482	1.466	> 0.05			

A and B give the output of the logistic mixed-effects models fit to the accuracy data between years between conditions (A) and within the cognate condition (B). Significant effects are marked with *. Model fit statistics are as follows: A (AIC = 1892.9, BIC = 1952.1, log-likelihood = –935.4), B (AIC = 914.2, BIC = 969.6, log-likelihood = –445.1). Intercept values are as follows: A (second-year, noncognate task, Indo-European language, less exposure to Russian outside of class, median of hours spent studying, better grades, no study abroad), B (second-year, noncognate item, item not following a cognate, Indo-European language, less exposure to Russian outside of class, median of hours spent studying, better grades).

The participants also reported how long they spent studying Russian each week on average. The overall average for all 22 participants was 7.98 hours per week outside of class.

All of the participants had studied another language previously to their study of Russian. These languages were Spanish (12), French (5), Latin (4), German (3), Czech (2), Japanese (1), Uzbek (1), and Georgian (1). Some had studied more than one language previously. The participants also reported whether they were exposed to Russian outside of class; 54.54% reported yes. Of these 12, two cited their parents, five cited various types of media, one cited a Russian conversation group at his university, and one each cited Russian-speaking friends or in-laws. The two who cited their parents were not heritage speakers who grew up speaking Russian, but rather students whose parents had learned Russian in the past and could speak it with them.[13]

A qualitative analysis was also performed on the vocabulary-related mistakes the participants made when naming the images. Many of the participants mistakenly named items that were semantically or phonetically related to the target item. The most common mistakes are listed in Table 4. Some of the mistakes could be phonetically motivated, such as the confusion of *stul* 'chair' and *stol* 'table', which only differ by one sound. However, for the other words in Table 4, there must be some other motivation. For example, *čaška* 'cup', *stakan* 'glass', and *bokal* 'wine glass or goblet' have little to nothing in common phonetically, but share a semantic category of items that people can drink from or that hold liquid. These mistakes support the theory that concepts are stored separately from linguistic information, and that possible linguistic items that refer to targeted concepts compete in activation. They also support the theory of parallel spreading activation, as related items (both phonologically and semantically) seemed to activate each other. This will be discussed more below.

[13] The final questions asked the participants to list the parts of Russian they find most difficult. They also reported whether or not they still find themselves translating from English to Russian (or vice-versa) in their heads. Nineteen replied yes, that they still translate into or from English at least some of the time. The following were areas that the participants cited as difficult in Russian: listening, speaking, grammar, vocabulary, case, motion verbs, tense, aspect, word order, and reflexive verbs.

Table 4. Common mistakes made by the participants[14]
[Notes from inside the table appear at the top of the next page]

Semantic category	Words confused	Images	Mistake
Furniture	*stol* 'table'		Once called *stul** 'chair'
	stul 'chair'		Called *stol* 'table' many times
Body parts, appendages, and their associated clothing	*palec* 'finger'		Called *ruka* 'hand' and *ručka* 'pen'
	ruka 'hand'		Called *pal'cy*‡ (plural of *palec* 'finger')
	noga 'leg'		Called *nogti* 'nails'
	perčatka 'glove'		Called *ruka*‡ 'hand'
Things to drink out of, that hold liquid	*čaška* 'cup'		Called *stakan*** 'glass'
	bokal 'wine glass or goblet'		Called *stakan* 'glass' and *čaška* 'cup'
Things associated with mail, correspondence	*pis'mo* 'letter'		Called *markirovka*†
	konvert 'envelope'		Called *pis'mo*‡
	banderol' 'package'		Called *pis'mo*

* It is important to note here that the chair appeared before the table in the task, perhaps discouraging the mistake of calling the table a chair.

[14] The semantic categories above have been posited by the author. Other, less common, mistakes include: referring to a suitcase as a purse (*sumka* rather than *čemodan*) and confusing wallet and backpack (*portfel'* and *rjukzak*).

** *Stakan* is another word for a glass. Both of the items used in the task were called *čaška*, despite the fact that the actual *čaška* came first.

† The word for 'marking,' which is phonologically similar to the word for 'stamp,' *marka*.

‡ It is possible that in each of these cases the speaker's interpretation of the image caused the use of a different word that also applies to a portion of the image. For example, the speaker could interpret the image of the envelope as a sealed letter.

5. General Discussion

To review: it was predicted that second-year students would show a boost in reaction time and accuracy when cognates were presented, while fourth-year students would not show this effect or be distracted by the cognates. These predictions are not completely supported by the results. There was a facilitative cognate effect on reaction time within the cognate condition for second-year participants. They responded to cognate items faster than to noncognate items. Fourth-year students were overall more accurate than the second-year students in the cognate condition. Between conditions, the analysis revealed no significant effects on reaction time or accuracy. These results show that cognates do have a facilitative effect on reaction time, though the effect is more limited than predicted. Cognates only boosted the performance of the second-year participants within the cognate condition on cognate items.[15]

These results support the Revised Hierarchical Model (RHM) (Kroll and Stewart 1994), though in a different way than expected. It was predicted that the presence of cognates would facilitate activation of Russian for second-year students because they still rely on their links between the L1 and the concept store in activation. Fourth-year students, on the other hand, would be distracted by these cognates or unaffected, because they no longer need L1-based links. While there was a facilitative effect of cognates within the cognate condition at the second-year level, there was no significant difference in performance between the noncognate task and the cognate task. The boost in speed on cognate trials for the second-year participants may have resulted from their use of L1-based links to the concept store. The fourth-year students were more accurate overall within the cognate condition, but they were not faster or more accurate on the cognate trials. Their accu-

[15] In the future, a similar study with more participants may show a more distinct difference between the conditions, as is present in this study within conditions.

racy may have been boosted by the presence of cognates, but only in comparison to the second-year participants.

The facilitative effect of cognates supports the language nonspecific hypothesis (Fox 1996), which states that linguistic information from a bilingual's two languages is stored together and not separately. It also supports the theory that linguistic information is stored separately from conceptual information in bilingual and L2 learner memory (Bartolotti and Marian 2012; de Groot 2011). Cognates can positively affect reaction time and accuracy, indicating that the linguistic information pertaining to cognates is stored in such a way that links between a bilingual's two languages are present in bilingual memory. If languages were stored separately from each other, cognates could not have an effect, because they would not be connected in linguistic storage despite sharing conceptual space in LTM.

These results also support the theory of parallel spreading activation (Collins and Loftus 1975). As shown in Table 4, when a participant looked at an image of a package, the package was not the only concept or lexical item activated in his or her mind. Other related concepts were also activated, such as the letter or stamp. This shows that closely related lexical and conceptual items can be activated when only one concept that relates to that group of related items is targeted for activation. Phonologically related items may also be activated, accounting for the mistakes made with *stol* 'table' and *stul* 'chair'. No morphologically motivated mistakes were found in this study.

Mistakes such as those shown in Table 4 also indicate that activation is not linear, or the same mistake would be made each time. This supports the theory that there is no single locus for selection of linguistic information in activation (Kroll, Bobb, and Wodniecka 2006). Overall, the mistakes indicate that there are semantic and phonological connections between lexical items in a L2 learner's storage system. These results support models of bilingual memory that posit network-like connections between linguistic information, such as the BIA+ model (Dijkstra and van Heuven 2002; van Heuven et al. 2010).[16]

Finally, the results of this study support the findings of Hoshino and Kroll (2008), who found cognate facilitation despite the different

[16] As stated above, The BIA+ model uses a computational system of tagging that relates items in storage to each other through phonological, semantic, and morphological connections. The storage structure in this model is nonselective for language in activation.

orthographies of English and Japanese in a task where the orthography was not present. In this study cognates were facilitative for second-year students, showing that the cognate boost is present despite the different orthographies of English and Russian. This supports Hoshino and Kroll's assertion that a different orthography will only have an effect when script is present.

6. Conclusions

The purpose of this study was to determine whether or not cognates impact the performance of L2 learners of Russian in a picture-naming task. The study was designed to test the Revised Hierarchical Model and theories about the structure of bilingual and L2 learner memory and storage. Because a cognate effect was found, the findings supported the RHM and theories of language storage that are non-specific for linguistic information. Cognates positively affected the speed of the second-year participants on cognate trials and may have positively affected the overall accuracy of the fourth-year participants in the cognate condition. This study provides a new look at cognates in Russian and English, and it provides a discussion of language storage in bilingual memory. Overall, the cognate effect has been supported again, across orthographies, in Russian.

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Appendix: Words Used in the Task[17]

1. Non-cognates

apple, яблоко (*jabloko*)
backpack, рюкзак (*rjukzak*)
bathtub, ванна (*vanna*)
bed, кровать (*krovat'*)
book, книга (*kniga*)
boot, сапог (*sapog*)
box, коробка (*korobka*)
boy, мальчик (*mal'čik*)
bread, хлеб (*xleb*)
butter, масло (*maslo*)
cake, торт (*tort*)
car, машина (*mašina*)
cat, кошка (*koška*)
chair, стул (*stul*)
cheese, сыр (*syr*)
clock, часы (*časy*)
closet, шкаф (*škaf*)
couch, диван (*divan*)
cup, чашка (*čaška*)
ear, ухо (*uxo*)
egg, яйцо (*jajco*)
envelope, конверт (*konvert*)
eye, глаз (*glaz*)
finger, палец (*palec*)
fish, рыба (*ryba*)
floor, пол (*pol*)
flower, цветок (*cvetok*)
fork, вилка (*vilka*)
gift, подарок (*podarok*)
girl, девочка (*devočka*)
globe, мир (*mir*)
glove, перчатка (*perčatka*)
hand, рука (*ruka*)
hat, шляпа (*šljapa*)
house, дом (*dom*)
ice cream, мороженое (*moroženoe*)
leg, нога (*noga*)
letter, письмо (*pis'mo*)
mouth, рот (*rot*)
man, мужчина (*mužčina*)
map, карта (*karta*)
mushroom, гриб (*grib*)
onion, лук (*luk*)
package, бандероль (*banderol'*)
paper bag, пакет (*paket*)
pen, ручка (*ručka*)
pencil, карандаш (*karandaš*)
picture, картина (*kartina*)
plate, тарелка (*tarelka*)
purse, сумка (*sumka*)
rain, дождь (*dožd'*)
refrigerator, холодильник (*xolodil'nik*)
ring, кольцо (*kol'co*)
road, дорога (*doroga*)
sandwich, бутерброд (*buterbrod*)
shirt, рубашка (*rubaška*)
shoulder, плечо (*plečo*)
shower, душ (*duš*)
skirt, юбка (*juba*)
sock, носок (*nosok*)
spoon, ложка (*ložka*)

[17] Overall, the list of cognates used ranged from very close (e.g., *toster* 'toaster') to slight mismatch (e.g., *lev* 'lion'). These choices were based on the frequency ranges of each item in each language. For example, *rjukzak* 'backpack' is not considered a cognate, despite the possible cognate *rucksack*, because of the low frequency of *rucksack* in English. The cognate of *divan* 'divan, couch' is also low frequency, but this word was included as a cognate due to oversight.

suitcase, чемодан (*čemodan*)
table, стол (*stol*)
teapot, чайник (*čajnik*)
tie, галстук (*galstuk*)
tomato, помидор (*pomidor*)
train, поезд (*poezd*)
truck, грузовик (*gruzovik*)
umbrella, зонт (*zont*)
vacuum, пылесос (*pylesos*)
waiter, официант (*oficiant*)
washing Machine, стиральная машина (*stiral'naja mašina*)
window, окно (*okno*)
wine glass or goblet, бокал (*bokal*)
woman, женщина (*ženščina*)

2. Cognates

balcony, балкон (*balkon*)
banana, банан (*banan*)
binoculars, бинокль (*binokl'*)
bottle, бутылка (*butylka*)
bus, автобус (*avtobus*)
camera, фотоаппарат (*fotoapparat*)
OR камера (*kamera)*
cassette tape, кассета (*kasseta*)
cigarette, сигарета (*sigareta*)
doctor, доктор (*doktor*)
door, дверь (*dver'*)
guitar, гитара (*gitara*)
jacket, пиджак (*pidžak*)
jeans, джинсы (*džinsy*)
lamp, лампа (*lampa*)
lemon, лимон (*limon*)
lion, лев (*lev*)
music, музыка (*muzyka*)
nose, нос (*nos*)
piano, рояль (*rojal'*)
OR пианино (*pianino)*
radio, радио (*radio*)
rose, роза (*roza*)
salt, соль (*sol'*)
saxophone, саксофон (*saksofon*)
sweater, свитер (*sviter*)
telephone, телефон (*telefon*)
television, телевизор (*televizor*)
tiger, тигр (*tigr*)
toaster, тостер (*toster*)
toilet, туалет (*tualet*)
wine, вино (*vino*)