Reversed Concreteness Effect and Differentiated Cognate Processing Determined by Direction of Translation and L2 Proficiency

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Abstract
The present study aimed to investigate the cognate and concreteness effects in Bulgarian-English bilinguals at two levels of proficiency, using a visual word translation task. While the well-established cognate facilitation effect was replicated in both experiments, some novel findings emerged. First, a reversed concreteness effect was observed in backward translation at both levels of proficiency. In addition, the highly proficient participants displayed differential processing of cognates, so that they were translated faster from the native into the second language than in the opposite direction. The implications and possible interpretations of these findings are discussed.

Keywords: bilingualism; concreteness; cognates; proficiency; word translation; reaction time.

Introduction
The present study examines bilingual word processing by manipulating a semantic variable, namely concreteness, and cognate status in a word translation task. Previous research has demonstrated that concrete words are translated faster than abstract ones (e.g., De Groot and Poot, 1997; Van Hell & De Groot, 1998). To account for this effect, De Groot (cf. Kroll & De Groot, 1997) proposed the Distributed Feature Model (DFM), in which words are represented by a set of distributed features on various levels of representation (e.g., semantic, syntactic, lexical). On this view, conceptual features between the native language (L1) and second language (L2) meaning overlap to different degrees depending upon the type of word that is represented. Two main distinctions are made between words – the representation of concrete versus abstract words, and that of cognates versus non-cognates. Concrete words have direct sensory referents (e.g., “tree”) and thus have more similar meanings (i.e., share a larger number of features) across languages than do abstract ones – words which do not refer to directly perceptible entities (e.g. “freedom”). The assumption here is that the objects that concrete words refer to have similar functions across languages and cultures, leading to a more complete overlap of meaning.

Cognates, on the other hand, are words that share lexical form and meaning in both languages (e.g., “compass” in English and „компас” [kompas] in Bulgarian) in contrast to non-cognates, which share meaning but not lexical form (e.g., “butter” in English and „масло” [maslo] in Bulgarian). The DFM assumes that cognates have overlapping features on both the lexical and semantic level, which leads to their richer representation in memory.

Thus, according to the predictions of this model, due to the difference in the density of feature overlap, both concrete words and cognates would be translated faster than abstract words and non-cognates, respectively.

Another model of bilingual language processing is the revised hierarchical model (RHM), which assumes two independent lexical stores and a common underlying conceptual store (Kroll & Stewart, 1994; Kroll & de Groot, 1997). In addition, it assumes that the links between and within these two levels differ in terms of strength and as a function of proficiency. As a person learns a new language, he or she tends to associate the new lexical items with their translation equivalents in his/her L1, forming strong lexical links in the L2-L1 direction. Respectively, the L1 lexicon is directly linked to the conceptual store. The links in the L2-L1 direction are more often lexically mediated, whereas those in the opposite direction are primarily conceptually mediated. In other words, when translating, a person encountering an L1 word is likely to access the conceptual store in order to process it, whereas the lexical link will be utilized when exposed to an L2 word. This difference in the strength of the connections between the two languages has been demonstrated in a number of studies using translation tasks (e.g. Kroll & Stewart, 1994; Francis, Augustini & Sáenz, 2003; but see also Tokowicz & Kroll, 2007), which report the existence of an asymmetry effect, also to be explained by the difference in the size of the two lexicons – a smaller L2 lexicon, compared to a larger and richer L1 lexicon. As a person’s proficiency in a language increases, the links between the L2 store and the conceptual store strengthen, decreasing the asymmetry.

In order to examine these asymmetries, two experiments were carried out with bilinguals at two different levels of
proficiency. What is different from most other studies in the field is that the less proficient group is actually quite fluent in the second language (and might even be comparable to the highly proficient bilinguals in some other studies). The reason for selecting two groups towards the higher end of the continuum of language proficiency was to explore finer distinctions in bilingual representation and processing.

Another aim of the study was to investigate the processing of concrete words and cognates. Cognate status in this study is defined as mainly phonological overlap between the two languages since Bulgarian uses the Cyrillic alphabet, although there is also some degree of orthographical overlap. Different studies report different results regarding the presence of concreteness effects in a word translation task. For example, De Groot & Poot (De Groot & Poot, 1997) demonstrated that abstract words were translated more slowly in both directions of translation and across three groups of bilinguals at different levels of proficiency. This was interpreted as evidence that both directions of translation involve concept mediation, but might differ in terms of the processing stages. In another study (van Hell & De Groot, 1998), an attempt was made to disentangle the influence of context availability (i.e. the ease and speed with which one can think of a situation or circumstance in which a particular word can be used) from that of concreteness status. The results showed a disappearance of the concreteness advantage when words were matched for context availability, interpreted as showing the difference in density of the conceptual networks. Thus, concrete words share more conceptual features across languages and are less dependent on linguistic context for their meaning. Matching concrete and abstract words on context availability would lead to equivalent availability of associated contextual information, providing equal support for activation of both types of words.

Finally, the study aimed to test the predictions of the two models described above. An assumption following from the RHM is that semantic variables should influence less proficient bilinguals and the L2-L1 direction to a lesser extent, reflecting the more lexical-level nature of the links between representation levels. The DFM would predict slower response times for abstract words for both groups, and a possible larger concreteness effect for the lower proficiency group due to their more inconsistent mappings of semantic features for abstract words across languages.

The reported experiments aim to contribute to the bulk of bilingual research by investigating several effects for which contradictory results have been found in the past, namely, asymmetry of direction of translation and potential differences in processing of concrete and abstract words when both are high in context availability. Furthermore, the difference in the level of proficiency of the participants is smaller than that in most studies, so as to exploit finer distinctions in these effects.

**Experiment 1: Highly Proficient Bilinguals**

**Method**

**Participants** 22 professional university teachers of English (5 male and 17 female) volunteered to participate in the experiment (mean age 33.4; SD=5.4). They had been studying the language for an average of 20.3 years and worked with it on a daily basis. All of them had normal or corrected to normal vision. All participants filled in a second language history questionnaire. Table 1 presents means and standard deviations of three self-reported measures.

<table>
<thead>
<tr>
<th>AoA</th>
<th>Length</th>
<th>Speaking</th>
<th>Reading</th>
<th>Writing</th>
<th>Listening</th>
</tr>
</thead>
<tbody>
<tr>
<td>M(SD)</td>
<td>M(SD)</td>
<td>M(SD)</td>
<td>M(SD)</td>
<td>M(SD)</td>
<td>M(SD)</td>
</tr>
<tr>
<td>9.7(3.6)</td>
<td>20.3(6.4)</td>
<td>5.9(0.6)</td>
<td>6.3(0.6)</td>
<td>6.0(0.5)</td>
<td>6.3(0.6)</td>
</tr>
</tbody>
</table>

*Note. AoA – age of the second language acquisition (in years), Length – length of L2 study (in years), Speaking, Reading, Writing, Listening – subjective proficiency rating of the respective skills on a 7-point scale (7 – the most proficient).*

**Stimuli and Design** English stimuli were selected from the extended Clark & Paivio database (2004), 26 items per condition. Since no extensive norms are available for all word properties in Bulgarian, the stimuli used in the present study were matched for ambiguity in terms of their ratings for English (Clark & Paivio, 2004). It was not possible to match all stimuli for context availability, so care was taken to select only words with high context availability ratings (min. 5.24 out of 7). All of the stimuli were nouns. The Bulgarian equivalents for most concrete words were taken from a database with 520 pictures and their dominant responses in seven languages including English and Bulgarian (Szekely et al., 2004), which served as a kind of control of translation equivalents and as a source of Bulgarian lexical items for the experiment. For abstract and concrete items which were not included in the database, translation equivalents were generated by a near-native speaker of English. Translation equivalents for both groups were then double-checked by a professional translator.

The English word frequency data were based on Hyperspace Analogue to Language (HAL) frequency norms which consist of approximately 131 million words (Balota et al., 2007). These were converted into frequency score per million and then 10-base logarithm of the score was taken with one added to the score per million to avoid the undefined Lg(0). In addition, the words were coded for word length...
measured in number of letters. Imageability, concreteness, context availability and ambiguity scores for English items were taken from the Clark & Paivio database (2004). All English words were matched for frequency, and abstract and concrete stimuli were matched within groups for length, imageability, concreteness, and ambiguity (see means and SDs in Table 2). Objective word frequency data for Bulgarian words were derived from a 72-million data base (Simov et al., 2004), and the same procedure of conversion into one-million score and logarithm taking was applied. T-tests showed that English words were more frequent than Bulgarian words, but that was consistent for all item groups (p<0.05).

Table 2: Means and standard deviations (in parentheses) of 6 word characteristics for the English stimuli.

<table>
<thead>
<tr>
<th></th>
<th>Freq</th>
<th>Length</th>
<th>Image</th>
<th>Concr</th>
<th>CA</th>
<th>Amb</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC</td>
<td>1.8(6)</td>
<td>6.4(1.6)</td>
<td>6.3(4)</td>
<td>6.7(3)</td>
<td>6.6(3)</td>
<td>2.3(5)</td>
</tr>
<tr>
<td>CNC</td>
<td>1.9(4)</td>
<td>6.4(1.4)</td>
<td>6.3(3)</td>
<td>6.7(3)</td>
<td>6.6(2)</td>
<td>2.2(4)</td>
</tr>
<tr>
<td>AC</td>
<td>1.9(6)</td>
<td>6.8(1.2)</td>
<td>3.5(9)</td>
<td>2.3(4)</td>
<td>6.1(4)</td>
<td>2.8(6)</td>
</tr>
<tr>
<td>ANC</td>
<td>2.0(4)</td>
<td>6.6(1.8)</td>
<td>3.6(8)</td>
<td>2.2(5)</td>
<td>6.5(2)</td>
<td>2.8(4)</td>
</tr>
</tbody>
</table>

Note. CC – concrete cognates, CNC – concrete non-cognates, AC – abstract cognates, ANC – abstract non-cognates, Freq – Log10(Frequency per million+1), length – word length measured in number of letters. The following characteristics represent ratings on a 7-point scale with 7 being the highest and 1 the lowest rating: Concr – concreteness, Image – imageability, CA – context availability, Amb – number of meanings.

The experiment had a 2 x 2 design: 2 (Word Type: Cognate vs. Non-cognate) x 2 (Language of presented stimulus: English vs. Bulgarian).

**Procedure** Four pseudo-randomized lists were constructed so that the same condition appeared no more than 3 consecutive times and so that there were at least three non-animate words between two animate. Each list contained 52 English and 52 Bulgarian words. Each stimulus was presented only once to each participant either in English or in Bulgarian. The experiment was divided into two experimental blocks in order to avoid fatigue effects in a mixed-language type of presentation that demands a high level of concentration.

Participants were tested individually in a sound-proof booth. The experimental session started with 8 practice trials, none of which appeared in the experimental part. Each trial started with a fixation cross “+” for a random time from 400 to 600 ms. After cross disappearance a word was displayed for 3000 sec or until a subject’s response was generated. Stimuli were presented at the center of the screen in black uppercase letters, Bulgarian Times, size 18, against a white background. Participants were instructed to translate words as fast and as accurately as possible into the corresponding language (from Bulgarian into English and from English into Bulgarian). The intertrial interval varied randomly between 1.7 and 2 sec. Responses were recorded by the experimenter. Reaction time (RT) was measured from the onset of each stimulus. A serial response button box recorded voice onset RT. Stimulus presentation and response recordings were controlled by E-prime software (Schneider, Eschman, & Zuccolotto, 2002). The experiment took about 15 min.

**Results and Discussion**

The following types of errors were identified and excluded from the data prior to analysis. Trials on which no response was registered (0.4%), registering of another sound (1.3%), wrong translation (0.7%), an alternative but legitimate translation (3.4%), no answer (1.7%), and simple word reading (0.04%). Further, response times lying more than ±2 standard deviations from the mean per condition were also removed, amounting to 4.5%.

Thus, a total of 85.6% of the originally collected RT data were included in further analyses. The reported results are based on both item and subject analyses. A 2 (cognate status) x 2 (concreteness) x 2 (language) repeated measures ANOVA was performed for item means, with language as a within-group variable and cognate and concreteness status as between-group variables, and for subject means, with language as a between-group variable, and cognate and concreteness status as within-group variables. Table 3 shows item mean response times and SDs per condition.

Table 3: Mean response times (in ms) and SDs (in parentheses) for four experimental conditions, item means.

<table>
<thead>
<tr>
<th></th>
<th>Concrete</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cognate</td>
<td>Neocognate</td>
</tr>
<tr>
<td>Bg-En</td>
<td>888(106)</td>
<td>1034(108)</td>
</tr>
<tr>
<td>En-Bg</td>
<td>945(100)</td>
<td>1001(133)</td>
</tr>
</tbody>
</table>

Note. DR – direction of translation.

A main effect of cognate status was found both in the analysis by items and subjects (F(1,98)=35.98, p<0.001; F(1,42)=79.015, p<0.001), so that cognates were translated faster (909 ms) than non-cognates (1028 ms, cf. Table 3). A language by cognate status interaction (F(1,98)=20.63, p<0.001; F(1,42)=13.79, p<0.001) is presented in Figure 1. It can be seen that cognates were translated faster from Bulgarian into English, whereas the reverse was true for non-cognates, which was confirmed by a post-hoc analysis (all p<.05). The pattern observed for non-cognates is in agreement with the predictions of the RHM in that backward translation relies more heavily on lexical-level links, leading to faster response times.
The results observed for cognates, however, show an interesting finding. In addition to the dominance of L1 and, consequently, faster phonological activation of L1 words (cf. Jared & Kroll, 2001), this could be interpreted as pointing towards the influence of orthographic-phonological level interactions and specific characteristics of the orthographic systems. As discussed above, the overlap for Bulgarian-English cognates is mainly on the phonological level. Since Bulgarian is a language with a relatively transparent orthographic system, it would be logical to assume that a Bulgarian word will activate its phonological code more quickly (and, respectively, word recognition and processing), leading to faster processing time and production of the respective equivalent than when an English word has to be recognized and translated.

To summarize, the results replicated the cognate facilitation effect, but a new interaction was observed, so that backward translation was faster only for non-cognates. In addition, the concreteness advantage was reversed in L2-L1 translation.

**Experiment 2: Less Proficient Bilinguals**

**Method**

**Participants** Twenty university students (9 male) participated in the experiment. They were either studying English as their first or second language at the “Foreign Languages and Cultures” Department or were in English classes for preparation for the Cambridge Certificate in Advanced English. In addition to their self-assessment, their English teachers were consulted regarding the students’ proficiency in English, so as to achieve better homogeneity of the group. All of them had normal or corrected to normal vision. Table 4 presents means and standard deviations of six self-reported measures.

<table>
<thead>
<tr>
<th>AoA (M(SD))</th>
<th>Length (M(SD))</th>
<th>Speaking (M(SD))</th>
<th>Reading (M(SD))</th>
<th>Writing (M(SD))</th>
<th>Listening (M(SD))</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.2(3.6)</td>
<td>10.9(3.7)</td>
<td>5.1(1.1)</td>
<td>5.5(1.8)</td>
<td>4.7(1.1)</td>
<td>5.7(1.3)</td>
</tr>
</tbody>
</table>

**Note.** AoA – age of the second language acquisition (in years), Length – length of L2 study (in years), Speaking, Reading, Writing, Listening – subjective proficiency rating of the respective skills on a 7-point scale (7 – the most proficient).

**Stimuli, Design, and Procedure** The same stimuli, design and procedure as in Experiment 1 were used.
Results

The data from block 2 for one participant was lost due to equipment failure. Otherwise, the data trimming procedure was the same as in Experiment 1, leading to exclusion of the following: Trials on which no response was registered (0.9%), registering of another sound (4.1%), wrong translation (2.8%), an alternative but legitimate translation (2.9%), no answer (9.5%), and simple word reading (0.1%). Response times lying more than ±2 SDs from the mean per condition (4.1%). As can be seen, the error rates for this group were quite high, which is attributed mainly to the lower proficiency of the participants, as well as task demands.

Thus, a total of 75.6% of the originally collected RT data were included in further analyses. The reported results are based on both item and subject analyses. Similarly to the analyses conducted in Experiment 1, both types of averaged data were analyzed with repeated measures ANOVA. Table 5 presents item means and standard deviations for each condition in ms.

Table 5: Mean response times (in ms) and SDs (in parentheses) for four experimental conditions, item means.

<table>
<thead>
<tr>
<th>DR</th>
<th>Concrete</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cognate</td>
<td>Neocognate</td>
</tr>
<tr>
<td>Bg-En</td>
<td>1011(177)</td>
<td>1157(178)</td>
</tr>
<tr>
<td>En-Bg</td>
<td>1031(169)</td>
<td>1079(167)</td>
</tr>
</tbody>
</table>

Note. DR – direction of translation.

The results showed that the main effect of cognate status was significant both in the analysis by items and subjects (F(1,98)=11.41, p<.01; F(1,38)=16.467, p<.001), replicating the cognate effect (cf. Table 5). A main effect of language was observed in the analysis by items (F(1,98)=6.08, p<0.05), but failed to reach significance in the analysis by subjects (p>0.1), so that translation from English into Bulgarian was faster (1036 ms) than translation from Bulgarian into English (1081 ms, see Table 5). A language by cognate status interaction (see Figure 3) was significant in the analysis by items (F(1,98)=4.21, p<.05). A post hoc analysis revealed that cognates were translated equally fast from both languages, whereas non-cognates took longer to translate from Bulgarian into English. This replicates most findings in the field (e.g. Sanchez-Casas, Davis & Garcia-Albea, 1992), which show that cognates are not affected by the direction of translation and suggests that this effect might interact with proficiency (since a different result was observed in the more proficient group).

No concreteness effect was found in the item analysis (F(1)=0.601, p=0.44). However, analysis by subjects revealed a trend towards a reversed effect of concreteness (F(1,38)=3.593, p=0.065), so that abstract words were translated faster (1036 ms) than concrete words (1063 ms, cf. Table 5). A separate analysis by languages showed that the effect was present only in the translation from English into Bulgarian (F(1,19)=5.0862, p<.05), replicating the results from Experiment 1.

Conclusion

The present study aimed to investigate the influence of two word properties in a word translation task and test the predictions of the revised hierarchical model and distributed feature model, using Bulgarian-English bilinguals at two levels of proficiency. Both groups showed a strong cognate effect and a reversal of the concreteness effect in backward translation, so that abstract words were translated faster than concrete ones. However, only the more proficient group showed a standard concreteness effect in forward translation, supporting the assumptions of the RHM of asymmetrical links between the lexical and conceptual levels for the two lexicons of a bilingual.

The reversal of the concreteness advantage in backward translation here is interpreted as pointing towards lexical-level processing of abstract words due to the lesser number of conceptual features they share across languages. In addition, it suggests that the strengthening of the links between the conceptual and lexical levels for L2 with increasing proficiency might differ for abstract and concrete words, so that stronger links between the two levels and richer semantic representations for L2 concrete words are established faster and more firmly, while L2 abstract words depend on their L1 translation equivalents via lexical-level associations. This could also be accommodated within the DFM if one assumes that the poorer representation of abstract words at the conceptual level (fewer shared features) leads to the utilization of the stronger lexical-level links in processing when they have to be translated.
The predictions of the RHM were also confirmed in terms of an observed asymmetry in the direction of translation for noncognates, especially in the higher proficiency group.

The cognate facilitation effect found across various languages and tasks (e.g., Dijkstra, Grainger & van Heuven, 1999; Costa, Santesteban & Caño, 2005; for a detailed review, see Sherkina, 2003) was replicated in the present study but showed different interactions depending on the proficiency level of the participants. While in the lower proficiency group cognates were unaffected by the direction of translation, in the higher proficiency group cognate status was affected differently by the two directions of translation. This result is interpreted as springing both from language dominance and the orthographic level, such that the higher level of transparency of the Bulgarian orthographic system leads to faster activation of the phonological code for cognates and, respectively, production of their English translation equivalent. To see whether this is truly the case, however, further studies are necessary, exploring orthographic level distinctions.

Acknowledgments
We would like to express our special gratitude to our volunteer participants for their patience and willingness to help and two anonymous reviewers for useful comments and suggestions.

References