Cognate facilitation effects in trilingual word recognition

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Abstract

Research on bilingual word recognition suggests that lexical access is nonselective with respect to language, i.e., that word representations of both languages become active during recognition. One piece of evidence supporting nonselective access is that bilinguals recognize cognates (words that are identical or similar in form and meaning in two or more languages) faster than noncognates. In fact, any difference between how cognates and 'monolingual' words are processed by multilinguals would indicate that the other, currently irrelevant language must have played a role as well, at least as long as the two groups of words are comparable with respect to all dimensions other than language membership. The aim of the present paper is to report on two visual perceptual experiments conducted within the lexical decision task paradigm whose aim was to test the assumptions concerning the special position of cognates (the cognate facilitation effect, cf. Dijkstra, 2005) within a trilingual mind and to answer the question whether trilinguals rely upon their second language lexical knowledge when recognizing L3 words. The results of the experiments attest to simultaneous activation and parallel processing as well as interaction among all the three languages. At the same time, they point to the fact that cross-linguistic lexical access and the source and strength of transfer may be constrained by variables such task demands.

Keywords: multilingual mental lexicon, nonselective lexical access, cognates processing

Nonselective Lexical Access and the Cognate Effect

The majority of empirical evidence gathered in psycholinguistic and neurolinguistic studies seem to support the contention that during bilingual lexical access, even if the two languages are indeed represented differently, both are activated, although perhaps to different degrees (cf. De Bot, Lowie, & Verspoor, 2007; Dijkstra, 2007). According to the BIA+ model (Dijkstra & Van Heuven, 2002a), the visual presentation of a word to a bilingual person leads to parallel activation of orthographic input representations both in the native language (L1) and in the second language (L2). These representations then activate associated semantic and phonological representations, leading to a complex interaction (or *resonance process*; Dijkstra & Van Heuven, 2002a, p. 183) between codes from which the lexical candidate corresponding to the input word emerges and is recognized.

In recent years, more and more studies (cf. De Bot et al., 2007; Lemhöfer et al., 2008) have reported evidence in support of language nonselective access with respect to form (orthographic and phonological) as well as semantic representations. Many studies conducted to prove the nonselective access perspective used orthographic neighbours as stimulus materials. An orthographic neighbour is "any word differing by a single letter from the target word with respect to length and letter position" (Dijkstra, 2005, p. 187). It has been confirmed that in monolingual word recognition many possible words initially become active on the presentation of a letter string, and the reader is usually not aware of them; only the word that is eventually recognized becomes available to awareness. Similarly, empirical studies show that neighbours from both the same and the other language are activated during the presentation of a target word. This provides evidence that, with respect to orthographic codes, the lexicon of bilinguals is integrated and nonselective in nature. Notably, Jared and Kroll (2001) in their word naming study showed that the same conclusions hold for the phonological part of the bilingual lexicon.

Perhaps the strongest results in favour of nonselective access concern experiments that report reaction time (RT) differences for interlingual homographs and cognates under different experimental conditions. In fact, cognates have been very useful as tools to investigate the multilingual mental lexicon and language (non)specificity of lexical access in both bilinguals and multilinguals (cf. Friel & Kennison, 2001). A multitude of previous studies carried out in different languages suggests that the distinction between cognate (words that are similar in form and meaning) and noncognate (words only similar in meaning) translations is consequential to the processing of this type of words (cf. *the cognate facilitation effect*, Dijkstra, 2005) and can be relevant

in determining how words are represented in the multilingual lexicon. The general finding is that cognates are produced, recognized, and translated faster than noncognates (cf. Costa, Santesteban, & Caño, 2005; De Groot & Nas, 1991; Dijkstra, Grainger, & Van Heuven, 1999; Lemhöfer et al., 2008; Voga & Grainger, 2007). The faster production, recognition, and translation of cognates are usually attributed to a common set of form-based representations (e.g., orthographic, phonological, morphological) that are used to process them in both (or more) languages. If access is language selective, the fact that words are cognates or have many neighbours in another language should have no effect on RTs. If access is nonselective, candidates from both languages will present themselves and this competition will lead to longer RTs. A large number of studies have been done on this and the overwhelming evidence in favour of the nonselective access hypothesis cannot go unnoticed.

One source of information in favour of the nonselective access are experiments conducted within the lexical decision paradigm. By way of example, in their RT study Lemhöfer and Dijkstra (2004) found that cognates were recognized faster than the matched English and Dutch controls. Because at the same time the homographs (having an identical orthographic form across languages) did not show any effects (relative to Dutch controls), the effect for cognates appears to depend at least on their overlap in meaning across languages. In other words, there must have been co-activation of the semantics of the cognates in both languages. In fact, it may be that cognates are represented in a special way, with a strong link between orthographic and semantic representations. Another source of information supporting the nonselective hypothesis is data from eye-tracking studies and brain-imaging studies (cf. Marian & Spivey, 2003; Midgley, Holcomb, & Grainger, 2011; Wartenburger, Heekeren, Abutalebi, Cappa, & Villringer, 2003). The data are interpreted as evidence for simultaneous activation of both languages in the early phonetic stages of perception. Also, the data coming from cross-linguistic priming and repetition effect tasks (cf. Altarriba & Basnight-Brown, 2009; Basnight-Brown & Altarriba, 2007) clearly support the nonselective access view.

It has to be noted that all the above mentioned experiments concern out-of-context word recognition performance. The empirical data reviewed in the previous paragraphs indicate that language nonselectivity is a compelling feature of this type of recognition. This means that word candidates from different languages initially become active on the presentation of a letter string. This nonselectivity seems to hold for all representations that characterize words (e.g., orthographic, phonological, and semantic codes). Further, bilingual word recognition also seems to be automatic in the sense that the process takes place relatively unaffected by nonlinguistic contextual factors. This

applies not just to words from the L1, but also to words from the L2 or L3. At the same time, some research is still needed to verify whether language nonselectivity is maintained or eliminated in context since the empirical data gathered thus far show that when words are processed in sentence context, their processing seems to be sensitive to the semantic and syntactic aspects of the sentence (cf. Hartsuiker & Pickering, 2008). Consequently, some researchers point to the possibility that even if access to the identification system is basically nonselective in nature, particular circumstances might allow it to operate in a language selective way. In fact, there is a clear evidence in the literature that task demands can affect multilingual performance to a considerable extent. By way of example, in the experiments carried out by Dijkstra and Van Heuven (2002a) the informants appeared to be extremely sensitive to small variations in task demands and the composition of the word lists. Many researchers even claim that it may be inappropriate to talk about multilingual word recognition in general without specifying the precise task and experimental circumstances under which it takes place because performance is both task and context dependent (cf. Dijkstra, 2007; Lemhöfer & Radach, 2009).

The Present Study

The aim of the present study was to verify the language-specific or language-integrated nature of multilingual lexical processing by examining the issues connected with the lexical organization of cognates. In particular, the two experiments were conducted to investigate how cross-linguistic overlap in orthography and semantics affects trilingual word recognition in different variants of the lexical decision task. It needs to be noted that since the research stimuli used in the experiments comprised only cognate nouns, all the results and their implications for connections between languages in the trilingual mental lexicon refer to this particular group of words. As regards methodology, an experimental setup was chosen for which the most reliable and frequently replicated bilingual cognate effects have so far been obtained, namely a lexical decision task. The logic behind using this type of task is that it requires individuals to search their lexicons for a lexical representation that matches the letter string presented. The representation of a lexical item contains information regarding the word's orthography, phonology, and semantics, and these aspects of the word are retrieved during the task.

In the Polish context, research on the multilingual mental lexicon and the role cognates play in its organization and processing is still rather limited. Hence the desire of the present author to verify the applicability and generalisability of the findings of multilingual research to the Polish setting.

According to statistical data published by the Central Statistical Office of Poland (GUS in Polish), English is the first and German the second foreign language in Polish schools (cf. Dmochowska, 2010). Taking this language constellation as the basis for empirical research guaranteed a wide number of reliable respondents. The other reason for choosing to use this pair of foreign languages throughout the experiments is related directly to the ready availability both of natural cognates and noncognates between German and English.

Experiment 1 – Cognate Effects in Trilingual Word Recognition

To investigate whether the nonselective access hypothesis holds also for trilinguals and three languages, Polish-English-German trilinguals carried out a lexical decision task in their third (weakest) language – German (cf. Dijkstra et al., 1999; Lemhöfer & Radach, 2009). In the present experiment, the word materials included purely German control words, 'double' cognates that overlapped in Polish and German, but not in English, and 'triple' cognates with the same form and meaning in Polish, German, and English (cf. Lemhöfer, Dijkstra, & Michel, 2004).

First, it was expected that the participants would react faster and more accurately to German-Polish cognates than to German control words. Such a finding would replicate the standard cognate effect (cf. Djikstra & Van Heuven, 2002a, 2002b) for a new language combination and provide additional evidence in support of language nonselective access. Second, an even stronger view of language nonselective access would be supported if three languages at a time can influence word recognition. In that case, the cognate status of the stimuli with respect to English should have an additional effect on top of the standard cognate effect. In other words, the recognition performance for German-Polish-English cognates should be even faster and more accurate than that for German-Polish cognates. If that turned out to be true, the experiment would replicate the Lemhöfer et al. (2004) study conducted for a different combination of languages and add further evidence to the discussion of the nonselective visual word recognition in the multilingual mental lexicon.

Participants. The experiment involved 27 trilinguals with Polish as their L1, and English and German as L2 and L3. All the participants were 'unbalanced' trilinguals; that is, they were not as proficient in their second and third languages, English and German, as in their mother tongue, Polish. All of the testees were students (second- and third-year) in the Institute of English Studies at the University of Łódź. All of them had learned English and German as a foreign language at school. The participants' L2 competence was not tested

before the study. It was assumed that their status of students of English Philology ensured advanced L2 proficiency. Before the experiment, however, a language background questionnaire was administered, in which 31 prospective participants were asked to report on their competencies in all of their foreign languages. 4 students had to be excluded from the experiment due to their relatively advanced knowledge of Spanish that could affect the results. Additionally, a few respondents declared some competence in French, Italian or Russian, but those selected for the experiment described their competence as very low. To ensure that the testees constituted a homogenous sample as far as their L3 (German) competence was concerned, only those students were selected who described their L3 level as pre-intermediate (A2) or intermediate (B1), as specified by the Common European Framework for Languages (CEFR) descriptors. The data from 3 participants had to be excluded due to their faulty performance, which sets the mortality rate of the experiment at 11 percent. The remaining 24 participants were between 20 and 24 years old with the mean of 21.66. 17 were female, 7 were male. All the participants were right-handed. They were not paid for their participation, nor given any course credits.

Procedure and materials. During the experimental session, which took about 30 minutes, the participants carried out a German lexical decision task involving triple Polish-English-German cognates (hereafter referred to as PGE cognates), double Polish-German cognates (PG cognates) and German control words. These critical groups of L3 words were compared with respect to the latencies and accuracy of their recognition: one quarter of the L3 words were cognates with their translations in Polish (e.g., *dach*, meaning 'roof' in both Polish and German), one quarter of the L3 words were cognates with their translations in both Polish and (L2) English (e.g., *plan*), and the remaining words were noncognates – German control words that were different from both their Polish and English translations (e.g., *kopf*, meaning 'head', *głowa* in Polish). In addition to the test stimuli, two German words as well as two PGE cognates, two PG cognates and two nonwords, all different from any of the test stimuli, were selected as practice items. In the word materials only nouns were used because they are the only content words that possess the same lemma form in all three languages. Verbs and many adjectives are morphologically marked by suffixes in both German and Polish (e.g., German *sing-en* or Polish *śpiew-ać*, meaning 'to sing')*,* while they are not marked in English, which usually results in different lemma forms of these words in the three languages.

PGE cognates were selected from CELEX database (cf. Baayen, Pipenbrock, & Gulikers, 1995). They possessed the same spelling and meaning in all three languages, as exemplified by the word *plan*. All of them were singu-

lar forms of nouns with a length of between 4 and 6 letters and no more than two syllables. It was attempted to choose only cognates with both English and Polish frequencies high enough to potentially affect the responses. While in German and Polish the chosen items are used as nouns only, it was inevitable that in English some of these nouns are also used as verbs. However, in all cases the verb meaning was closely related to the noun meaning (e.g., *plan*, *echo*), so that semantic competition could be largely ruled out. For the group of PG cognates, nouns with orthographic and semantic overlap in Polish and German (e.g., *dach*, *pech* 'bad luck') were selected that matched the PGE cognates with respect to length, number of syllables and frequency. Matching took place on an item-by-item basis with support of the SPSS (13.0) software. All cognate translations had a nonidentical phonology, whereas 41% of the PG cognates had a nonidentical orthography. Additionally, only such cognates were selected that in CEFR lists are assigned to no higher than B1 level.

A number of nonwords that was equal to the number of words (48) was generated by changing one or more letters in an existing German noun of 4-6 letters. All nonwords were orthographically legal in German and did not exist as words in any of the three languages. They were all created with the help of WordGen (cf. Duyck, Desmet, Verbeke, & Brysbaert, 2004), an online program that uses the CELEX and Lexique lexical databases for word selection and nonword generation in Dutch, English, German, and French. Fourteen items were adopted from the studies by Lemhöfer and Dijkstra (2004) and Lemhöfer et al. (2004). The nonwords were matched to the word items in terms of their mean length and number of syllables – the mean number of letters was 4.68 and the mean number of syllables was 1.54.

Testing took place individually on a PC; a modified program based on the Reaction Time Instrument Builder was used. The subjects were seated at the 17-inch computer screen, where stimuli were presented in black 14-point uppercase Times New Roman on a white background. One button on the side of the dominant hand of the participants was assigned to the *yes* response, the other button to the *no* reaction. At the beginning of each trial, a fixation point appeared in the middle of the screen for 1 s, then a blank interval of 500 ms followed. Next, the test word appeared. The item stayed in view until a response had been provided or until a time-out of 5 s had passed. The next trial was started 500 ms after the response was given. All items were presented in uppercase letters, because in German the case of the first letter can be a cue for the syntactic class of a word (nouns are written with a capital). The experiment consisted of two blocks of 48 items each. The first two items of each block were warm-up items (a nonword and a German filler word) which were not included in the analyses. The participants took a short break (5 min) be-

tween the blocks. The order of items within the lists was pseudo-randomised with no more than four words or nonwords in a row.

Results and discussion. For the RT analysis, only correct responses were considered. The overall error rate (ER) amounted to 9.4%, including 8.1% on test words. Furthermore, RTs exceeding two times the standard deviation from the item mean counted as outliers and were excluded from the set of valid responses. Outliers accounted for 1.7% of all the responses and they were approximately equally distributed across conditions. Erroneous responses on test words (8.1%) were excluded from the analysis, so that 9.8% of the data were discarded in total. The data on the erroneous response matched item partners were not excluded since such a procedure could have led to too high a percentage of the excluded data points. Moreover, in many studies employing similar methodology (e.g., Lemhöfer et al., 2004; Van Hell & De Groot, 2008) results obtained with and without the exclusion of the data on the outliers and erroneous response matched item partners yielded comparable results.

Similarly to Lemhöfer et al.'s (2008) study, ERs and RTs were analyzed over participants only, because the selected cognates and controls were matched item-by-item and can be seen as an almost exhaustive set of items with the given restrictions. The data gathered in the experiment were entered into the SPSS (13.0) program for statistical analysis. The relevant data are summarized in Table 1.

Table 1 The mean RTs and ERs for participants in Experiment 1

	RT	*SD*	ER	*SD*
PGE cognates	743.17	25.74	5.2	3.7
PG cognates	765.92	32.74	7.8	4.1
German controls	819.58	66.48	11.4	6.2
German fillers	823.17	63.15	15.0	8.1
nonwords	897.73	91.16	7.7	4.9

The analysis of the obtained RTs indicates that all three languages became activated and influenced the subject's responses to the following targets. As can be seen from the data in Table 1, the participants responded much faster (743.17) to PGE cognates than to PG cognates (765.92) and to control words (819.58). These data indicate that both English and Polish were activated in the course of the experiment and that the word status influenced lexical access.

To investigate the influence of item type on RT, paired samples *t* test was conducted whose results are presented in Table 2. In brief, the obtained data point to the statistically significant activation of PGE and PG cognates.

Planned comparison showed that PGE cognates were recognized 76.42 ms faster than monolingual German control words. This difference turned out to be statistically significant (*t*(11) = 3.94, *p* < .005). Similarly, PG cognates were recognized 53.67 ms faster than control words. This difference also reached statistical significance (*t*(11) = 2.92, *p* < .05). Finally, cognate effect obtained for PGE cognates was bigger (22.75 ms) than that obtained for PG cognates, which was significant at *t*(11) = 2.36, *p* < .05.

Table 2 Paired samples *t* test for the three types of stimuli words in a German lexical decision task

Paired samples	Mean	*SD*	SME	*t*	*df*	Sig. (2-tailed)
PGE vs. control	- 76.42	67.26	19.42	-3.94	11	.002
PG vs. control	- 53.67	63.67	18.38	-2.92	11	.014
PGE vs. PG	-22.75	33.45	9.65	-2.36	11	.038

Also the analysis of RTs with ANOVA yielded similar results. There was a significant main effect of item type, *F*(2,33) = 9.004, *p* < .01. Moreover, planned comparison showed that PGE cognates were recognized faster than PG cognates, *F*(1,46) = 7.162, *p* < .01. Finally, PG cognates were responded to significantly faster than control words, *F*(1,46) = 12.584, *p* < .01.

Similarly, the analysis of ERs revealed a comparable pattern. Item type significantly influenced ERs, *F*(2,33) = 5.062, *p* < .05. Also planned comparisons indicated that there were significantly more errors on PG cognates than on PGE cognates, and more on German controls than on PG cognates. Both differences turned out to be significant: *F*(1,46) = 17.697, *p* < .001 and *F*(1,46) = 5.319, *p* < .05, respectively.

Statistically significant cognate effects obtained for PGE and PG cognates confirmed by RTs and ERs analyses conducted both with paired samples *t* test as well as one-way ANOVAs point to language nonspecific selection which extends to three languages. First, the 'standard' cognate effect in lexical decision for a new language combination (Polish and German) was replicated. PG cognates were responded to faster than exclusively German control words. Second, an additional cognate effect on top of the standard cognate effect could be demonstrated for the trilingual population: words that had the same form and meaning in all three languages were recognized even faster and more accurately than the matched PG cognates with a dissimilar English translation. This indicates that during the recognition of words in a given foreign language, not only the mother tongue, but even another non-native language (English) exerts influence on recognition performance. Admittedly, the obtained effects cannot be explained without the involvement of all three lan-

guages: If the participants had selectively activated their German lexicon, there should have been no cognate effect whatsoever; if they had only activated the relevant lexicon (German) and their native language (Polish), there would not have been any RT difference between PG and PGE cognates.

Clearly, the presented interpretation of the obtained results could be challenged. Firstly, it could be claimed that the difference between PGE and PG group might have been caused by the fact that not all words in the PG group were identical cognates. It needs to be noted that non-identical cognates are reported to be recognized more slowly (cf. Dijkstra, 2007; Lemhöfer & Dijsktra, 2004). However, an additional analysis conducted exclusively on the pairs of identical cognates repeated the results as confirmed by one-way ANOVA, $F(1,12) = 4.986$, $p < .05$. Secondly, it could be argued that the triple cognate effect might have been obtained due to the higher level of proficiency in L2 – English. Similarly, the lower level of L3 might have led to stronger L1-L3 connections triggering faster RTs for PG cognates. Doubtless, a similar experiment with participants declaring comparable, advanced levels of L2 and L3 proficiency would additionally help to verify the hypotheses. Finally, although the results do show that it is possible to have activation of three languages simultaneously, the present data alone leave the possibility that they may not all be activated in less favourable circumstances, for instance if the task language is L1 or if the participants' proficiency in their foreign languages changes. The influence of the former factor is to be verified in the subsequent experiment.

Experiment 2 – The Role of Task Demands in the Trilingual Processing of Cognates

If the mental lexicon of a trilingual is organized on the basis of item characteristics as the outcomes of Experiment 1 seem to indicate, words from all the known languages might be activated in response to incoming information. Interestingly enough, a number of previous studies, all of whose results were interpreted in terms of the language-nonselective view, differed in the languages that were relevant for task performance and/or the languages of the stimuli with which multilinguals (or, in fact, mainly bilinguals) were presented. In some studies, bilinguals were shown stimuli in both languages, and they had to respond to items from both languages (e.g., Dijkstra et al., 1999; Lemhöfer & Dijkstra, 2004) or only to items from one language (e.g., Dijkstra, 2003; Van Heuven & Dijkstra, 2010). Other, and perhaps stronger, evidence for the notion that knowledge of one language influences performance in the other language is provided by studies in which the stimulus list and the task demands involved words from one target language only. By far, the majority of these studies focused on performance in the first foreign language (L2; De Groot, Delmaar, &

Lupker, 2000; Dijkstra et al., 2010), which is less dominant than the native language being, at the same time relatively advanced. What is, however, worth noting is that some pioneering experiments using the second, typically weaker, foreign language as the target have also been reported of late (L3; Lemhöfer et al., 2004; Lemhöfer & Radach, 2009; Experiment 1 above).

According to Van Hell and De Groot (2008), the most critical way to study whether knowledge of one language affects performance in the other language is to create an experimental context in which multilinguals perform a lexical decision task exclusively in their dominant language (L1), and in which they are presented with L1 words. Admittedly, taking the nonselective access view to an extreme would imply that "words from both languages are activated even when the bilinguals are performing in their native and dominant language and in a purely native language context" (Van Hell & Dijkstra, 2002, p. 782). It needs to be emphasized, however, that for lexical decision tasks performed in L1, the findings are far from clear. Caramazza and Brones (1979) failed to find a cognate effect in the dominant-language task, as did Gerard and Scarborough (1989). Other authors, on the other hand, reported some effects of L2 knowledge on L1 word performance under similar circumstances (cf. De Groot et al., 2000; De Groot & Van Hell, 2005; Lemhöfer et al., 2008; Van Hell & Dijkstra, 2002). More importantly, Van Hell and Dijkstra (2002) documented an RT advantage for lexical decisions on native language words that were cognates with respect to a second language and even for decisions on words that were cognates with respect to a third language.

To be sure, the usually stronger cognate effects from L1 on L2 than from L2 on L1 indicate that L2 representations are generally activated less strongly or less rapidly than L1 representations, implying that they have less chance to affect the response when L1 is the target. In other words, when cognates are processed in a second or third language context, the first-language reading not only becomes active but it facilitates recognition as well (cf. Dijkstra, 2007; Lemhöfer et. al, 2008; Experiment 1 above). Consequently, it seems reasonable to claim that, in the previous experiment, before the L3 (German) target reading of a cognate became active, the L1 (Polish) reading had already affected target processing. In contrast, in the Polish language-specific lexical decision task, multilinguals can be assumed to respond to the first reading of the cognate they identify, which will often be their L1 reading. Thus, the cross-linguistic effect measured relative to Polish controls is expected to be considerably smaller. In fact, the question arises whether cognate effects are still present in the recognition of L3 cognates in a first-language context and if that were the case, will the cumulative influence of the stronger and the weaker

foreign language (L2 and L3) lead to even faster L1 recognition, thus adding evidence to the nonselective access extending to three languages.

Taken together, the issue under investigation is whether the cognate effects found for PGE and PG cognates in the German task relative to German (L3) control words (cf. Experiment 1) can also be demonstrated in comparison with Polish (L1) control words in a purely Polish task. If so, semantic and orthographic overlap of cognates should cause facilitatory effects on word recognition. Alternatively, overlap effects might be task dependent and nonsignificant relative to the Polish control words. This would indicate that, whereas the simultaneous activation of an L1 code affects the recognition of words in L2 and/or L3, the reverse is not the case.

Participants. Nineteen right-handed participants (14 women and 5 men), drawn from the group from Experiment 1, took part in the present study. Five students from the previous experiment did not participate in the present experiment. The two sessions were conducted within the interval of 6 weeks.

Procedure and materials. The apparatus and procedure of the lexical decision task in the present experiment were similar to those used in Experiment 1. The stimulus materials consisted of triple and double cognates from Experiment 1. However, since the language of the task was L1, German control words were replaced with Polish controls. Additionally, orthographically non-identical PG cognates were transformed into their Polish equivalents. As in Experiment 1, the three groups of words (i.e., cognates with English and German, cognates with German, and control words) were matched item-by-item (SPSS 13.0) for Polish frequency, length and number of syllables. A group of Polish fillers (12) and a group of nonwords (48) were also included. Again, in the word materials only nouns were used.

For the present Polish language-specific lexical decision experiment, only Polish control words that were purely Polish nouns were included. They were noncognates, and resembled neither their English, nor their German translation in either orthography or phonology; examples are Polish *noga* (*Bein* in German, *leg* in English) or *pies* (*Hund* in German, *dog* in English). In order to keep the proportion of cognates in the experiment at no more than 50% of the words, 12 additional pure Polish fillers were included with characteristics similar to those of the Polish control words. A number of nonwords that was equal to the number of words (48) originated by changing one or more letters in an existing Polish noun of 4-6 letters. All nonwords were orthographically legal in Polish. They did not exist as words in any of the three languages. The nonwords were matched to the word items in terms of their

mean length and number of syllables – the mean number of letters was 4.53 and the mean number of syllables amounted to 1.47.

Results and discussion. For the analysis of RTs, only correct reactions were considered. The overall ER was 7.4%. Furthermore, RTs that lay more than two standard deviations away from the item mean were considered out-liers. The percentage of outliers among the correct trials was 2.3%. Errors on test words accounted for 5.9%. In total, 8.2% of the data were excluded. The mean RTs, standard deviations, and ERs are listed in Table 3.

Table 3 The mean RTs and ERs for the participants in Experiment 2

	RT	*SD*	ER	*SD*
PGE cognates	728.58	21.53	4.2	3.1
PG cognates	746.33	43.22	5.3	5.3
Polish controls	757.17	36.24	8.4	6.2
Polish fillers	760.03	39.33	9.1	7.7
nonwords	792.15	47.15	10.2	11.1

The participants responded faster (728 ms) to PGE cognates than to PG cognates (746 ms) and control words (757 ms). To investigate the influence of item type on RT, paired samples t test was conducted whose results are presented in Table 4. Planned comparison showed that PGE cognates were recognized 29 ms faster than monolingual Polish control words. This difference turned out to be statistically significant ($t(11) = 4.11$, $p < .005$; $F(1,36) = 8.740$, $p < .005$). PG cognates were recognized only 11 ms faster than control words. This difference failed to reach statistical significance ($t(11) = .79$, $p = .44$). Similarly, the difference between PGE cognates and PG cognates turned out not to be statistically significant ($t(11) = 1.77$, $p = .10$). More importantly, the analysis of ERs revealed the same pattern. The fewest errors were made on PGE cognates, more errors were made on PG cognates, and the most errors were made on Polish control words. Nevertheless, only pairwise comparisons for PGE cognates and Polish control words gave statistically significant results ($F(1,22) = 4.405$, $p < .05$).

Table 4 Paired samples t test for the three types of stimuli words in a Polish lexical decision task

Paired samples	Mean	*SD*	SME	*t*	*df*	Sig. (2-tailed)
PGE vs. control	28.58	24.03	6.94	4.11	11	.001
PG vs. control	10.83	47.36	13.67	.79	11	.44
PGE vs. PG	17.75	34.62	9.99	1.77	11	.10

Interestingly enough, only the group of PGE cognates compared with their matched controls yielded statistically significant results both in RTs and ERs analysis. Since the difference in processing PG cognates and controls did not reach the significance level, nor did the difference between PGE and PG cognates, it may be argued that the weaker foreign language does not affect visual word recognition in the exclusively native language context. No significant influence of the weaker foreign language on the dominant language processing has been found. Nor was any data found that could support the contention that nonselective access in an exclusively native language context extends to three languages. To be sure, statistically significant results for PGE cognates in comparison to their matched controls are likely to be obtained due to the presence of the stronger foreign language – English (L2), not the cumulative effect of two foreign languages. Thus, it can be argued that the nonselective access hypothesis tested in the native language context has been found to be valid only as far as the stronger foreign language is concerned. Notably, another possible reason for the lack of L3 influence might be the fact that the trilingulas' L3 proficiency, relative to their target language proficiency, may have been too low to induce any noticeable effects on target language processing.

To analyze task dependency, the RT results, achieved for PGE cognates and for PG cognates under two different task conditions, have been correlated (cf. Table 5). By using the same stimulus materials as well as the same group of Polish-German-English trilinguals, in both a German language-specific and a Polish language-specific lexical decision task, the effects of cross-linguistic overlap were compared for exclusively German and exclusively Polish lexical decision variants. The paired difference for both PGE and PG cognates in comparison to their matched controls in a German lexical decision task turned out to be bigger than in the case of the Polish version of this task. Planned comparisons showed that both the difference in processing PGE cognates as well as PG cognates in comparison to their matched controls in two different language settings reached the significance level as confirmed by one-way ANOVAs: $F(1,41) = 8.695$, $p < .005$ and $F(1,41) = 5.972$, $p < .05$, respectively.

Table 5 Paired differences in RTs achieved for PGE and PG cognates in comparison to their matched controls in German and Polish lexical decision tasks (Experiments 1 and 2)

	German controls		Polish controls	
	Mean RT	*SD*	Mean RT	*SD*
PGE cognates vs. controls	76.42	67.26	28.58	24.03
PG cognates vs. controls	53.67	63.67	10.83	47.36

The obtained data can be interpreted with the support of the BIA+ model, according to which the activation of various lexical representations is constantly monitored by a task/decision system that subserves task execution and decision making (cf. Lemhöfer et al., 2004). The BIA+ model predicts that even for the same stimulus materials, different tasks will lead to systematically different response patterns, because responding can occur at different moments in time and can be based on different information sources.

Conclusions

Consistent with previous findings in the literature, the experiments reported in this paper proved that trilinguals processed cognates more quickly and more accurately than they processed noncognate control words. Obviously, the overlap of form and meaning across languages facilitated lexical access. The obtained results reveal that the cognate effect can accumulate over languages: While cognate status in one language caused shorter word recognition latencies, the additional cognate status in one additional language speeded up responses even more. Thus, it can be claimed that the notion of nonselective lexical access that has recently received growing support within the bilingual domain seems to generalise to trilinguals and three languages.

As mentioned before, Experiment 1 proved that processing the weakest language (L3) words entails automatic, parallel activation of candidate words in the dominant, stronger languages; not only L1 but also L2. It was concluded that in accordance with the nonselective access hypothesis the presentation of a word in one language automatically activates words from both the target and the nontarget languages in parallel. It logically follows from this that crosslinguistic effects may arise in both directions, manifesting themselves not only in a nondominant but also in a dominant target language. This assumption gave rise to the hypotheses set in the second experiment, whose aim was twofold. First, the influence of foreign language knowledge on native language performance in an exclusively native language context was studied. The objective was to verify the assumption in the light of which weaker language knowledge may influence performance in the dominant language. Needless to say, such a finding would additionally support nonselective access in multilingual lexicon. Second, using the same group of PG cognates in Experiments 1 and 2 allowed to verify the influence of task demands on the recognition of words and the hypothesis that cognate effects might be task dependent.

The finding that foreign language knowledge (in this case L2) affects L1 target word processing in an exclusively native language context provided additional support for the theoretical position that the language processing sys-

tem of multilinguals is profoundly nonselective with respect to language. On the other hand, the nonnative language influence on the mother tongue was clear only for L2 since only PGE cognates were recognized faster than their matched controls; L1-L3 cognates did not generate statistically significant results. Admittedly, it was L2 that supported the recognition. The comparison of the results for PG cognates from Experiment 2 with those from Experiment 1 showed that the same list of stimulus words, recognized by the same group of subjects generated different RTs. Clearly, language nonselective access in the case of three languages seems to be task-dependent. And although more research is needed to find out the exact nature of the demands posed by various tasks, Experiment 2 proved that the different results they produce may be informative with respect to the underlying representation of cognates. Summing up, processing words in the strongest language can be influenced by weaker language knowledge – in this case, L2 knowledge.

The study has certain limitations and implications for future research. It has to be admitted that it was difficult to fully control many individual as well as extraneous variables. Consequently, there are some shortcomings that need to be acknowledged and addressed. One of the extraneous variables that might have affected the validity of the experiments relates to population characteristics. The fact that the participants of the experiments were students at the philological department definitely limits the generalisability of the findings. Another participant-related variable influencing the results is connected with the number of respondents. Due to considerable difficulties in finding subjects with advanced levels of both English and German, the research groups were not very large (about 20 people). Luckily, the participant mortality rate was not statistically significant and, as the dropout was random, it did not affect the group homogeneity. Yet another limitation concerns the type of methodology itself. Since the lexical decision task entails single word recognition, it seems reasonable to believe that some research is still needed to verify whether the outcomes of the discussed experiments are maintained or eliminated in sentence context. All the more so, as there is a growing amount of empirical data showing that when words are processed in sentence context, their processing seems to be sensitive to the semantic and syntactic aspects of the sentence (cf. Hartsuiker & Pickering, 2008). All in all, it seems legitimate to predict that context effects could influence the findings to a large extent. Future studies should be conducted looking more closely at the level of proficiency. A question which remains to be tackled relates to the type of relationship that non-native languages establish with one another at a single point in time and over time, especially in view of the rapid changes in proficiency level non-native languages are subject to.

The underlying aim of the presented experiments was to verify the hotly disputed conceptualization of a multilingual learner. On the one hand, there are scholars who assume that there is no meaningful difference between bilinguals' and multilinguals' processes and accordingly classify all learners of one or more non-native languages as L2 learners, especially when proficiency in the previously learned non-native languages is low. On the other hand, there are researchers who argue that this position is not acceptable, as meaningful differences between these learners' processes exist and must be accounted for. One common argument in favour of the view that a difference between the two types of users exists is the contention that multilingual learners are influenced both by their L1 and the non-native languages they know. In a multilingual system, crosslinguistic influence takes place not only between the L1 and the L2 but also between the L2 and the L3, and the L1 and the L3, as well as in the reverse direction. The findings of the study confirmed this contention. Consequently, it seems legitimate to say that the native language does not always have a privileged status and must be looked at together with other possible sources of transfer. Since multilinguals have knowledge of more than two languages by definition, the possible sources of lexical transfer automatically increase with the number of languages the individual is familiar with – a phenomenon referred to as *combined cross-linguistic influence* (cf. De Angelis, 2007; Ringbom, 2007). Although it still remains little explored to date, the cumulative cognate facilitation effect, confirmed in the study, shows that two or more languages can interact with one another and concur in influencing the language of the task. In other words, when more sources are available, they have to be accounted for, whether used or unused by the learner.

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