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BRIEF REPORT

Concreteness effects in bilingual and monolingual word learning

Margarita Kaushanskaya · Katrina Rechtzigel

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Abstract Previous studies have demonstrated that bilingualism can facilitate novel-word learning. However, the mechanisms behind this bilingual advantage remain unknown. Here, we examined whether bilinguals may be more sensitive to semantic information associated with the novel words. To that end, we manipulated the concreteness of the referent in the word-learning paradigm, since concrete words have been shown to activate the semantic system more robustly than abstract words do. The results revealed that the bilingual advantage was stronger for novel words learned in association with concrete rather than abstract referents. These findings suggest that bilingual advantages for word learning may be rooted, at least in part, in bilinguals' greater sensitivity to semantic information during learning.

Keywords Human memory and learning · Bilingualism · Word meaning · Phonology · Semantics

Previous studies have suggested that bilingualism can facilitate performance on word-learning tasks (e.g., Kaushanskaya & Marian, 2009; Papagno & Vallar; 1995; Van Hell & Mahn, 1997). However, the mechanisms that underlie the effects of bilingualism on learning are currently unknown. One early suggestion was that the bilingual advantage for word learning was based in bilinguals' more efficient phonological memory system (e.g., Papagno & Vallar, 1995). However, in recent work we have shown that bilingual advantages for novel word learning are maintained when bilingual and monolingual participants are matched precisely on their phonological memory capacity (Kaushanskaya, in press). Therefore, it is likely that bilingual experience affects the learning process itself, rather than (or in addition to) the cognitive workspace (i.e., the working memory) within which learning takes place.

Although learning a word involves encoding both its phonological form *and* its meaning, and although learning can occur in a number of different ways, previous studies that examined the effects of bilingualism on word learning have typically used the paired-associates learning paradigm (rather than other types of word-learning paradigms) and probed for participants' ability to retrieve the native-language translations as the index of learning (e.g., Kaushanskaya, in press; Kaushanskaya & Marian, 2009; Van Hell & Mahn, 1997). A promising clue to how bilingualism may influence this particular word-learning process was yielded by analyses of word-learning errors made by bilingual versus monolingual learners (Kaushanskaya & Rechtzigel, 2012). In this previous study, participants were taught to associate novel words with English translations, and at testing, they were asked to produce the English translations when cued with the novel words. While a general pattern of bilingual advantages was uncovered, more interesting findings were observed when translation errors were analyzed. Errors were coded into two categories: sound-based errors (in which participants confused two similar-sounding novel words) and meaning-based errors (in which participants confused two English translations that shared a semantic category or that were associatively related to each other). The analyses of errors were conducted on the proportion data (e.g., on the number of sound-based errors out of the total number of errors) to correct for the fact that bilinguals made fewer errors overall than did monolinguals. When analyzed in this way, bilinguals made more meaning-based errors than did monolinguals. These results were

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M. Kaushanskaya (✉) · K. Rechtzigel
Department of Communicative Disorders,
University of Wisconsin–Madison,
1975 Willow Drive,
Madison, WI 53706, USA
e-mail: kaushanskaya@wisc.edu

interpreted to suggest that given the same task parameters and stimuli, bilinguals may be able to encode novel words more deeply (i.e., to the semantic level) than do monolinguals. The goal of the present study was to experimentally assess whether this was the case. We asked: Are bilinguals more sensitive to the semantic information associated with novel words during learning than are monolinguals?

In order to examine whether bilinguals and monolinguals differ in how they process semantic information during learning, we contrasted the learning of novel words in association with concrete versus abstract referents. In memory tasks, concreteness effects have been broadly confirmed (e.g., Hamilton & Rajaram, 2001; Miller & Roodenrys, 2009; Romani, McAlpine, & Martin, 2008; Walker & Hulme, 1999) using both paired-associates learning (e.g., Gee, Nelson, & Krawczyk, 1999) and novel-word learning paradigms (e.g., De Groot & Keijzer, 2000). Although the roots of concreteness effects continue to be debated, nearly all memory/learning studies that contrast concrete versus abstract words have revealed better performance on concrete words (e.g., De Groot & Keijzer, 2000; Hamilton & Rajaram, 2001; Miller & Roodenrys, 2009; Romani et al., 2008; Walker & Hulme, 1999), and *all* of the theoretical explanations for why concrete words are advantaged during processing entail semantic (rather than phonological) differences between concrete and abstract words. Thus, some studies have indicated that concrete words are processed by both the verbal and the image-based systems, while abstract words activate the verbal system only (Paivio, 1986, 1991; Paivio, Walsh, & Bons, 1994). Others have argued that concreteness effects are due to richer semantic representations (which may involve a wider network of prior contextual knowledge) for concrete words (e.g., De Groot, 1989; Grondin, Lupker, & McRae, 2009; Schwanenflugel & Shoben, 1983). For the purposes of the present study, we assumed that the ease associated with retaining concrete words is rooted in semantic factors. We therefore hypothesized that if bilinguals were more sensitive to semantic information during learning than monolinguals, the bilingual advantage for novel-word learning would be especially strong for concrete words.

The comparison of bilinguals and monolinguals on learning tasks contrasting the learning of novel words in association with concrete versus abstract referents also enabled us to examine the strength of concreteness effects in the two groups of learners. Theories of lexical processing in bilinguals generally posit that the semantic representations of translation equivalents in a bilingual's two languages overlap (e.g., Kroll & Stewart, 1994). However, there have also been suggestions that different types of words overlap in the bilingual semantic system to different degrees. Specifically, the distributed feature model (De Groot, 1992) posits that concrete words are more likely to share semantic features across bilinguals' two languages than are abstract words, and some behavioral evidence has suggested that concrete translation pairs across the bilingual's two languages may share a larger semantic overlap than do abstract translation pairs (e.g., Jin, 1990; Paivio & Desrochers, 1980; Van Hell & De Groot, 1998). As a result, bilinguals tend to translate concrete words more quickly than abstract words (De Groot, Dannenburg, & Van Hell, 1994; De Groot & Poot, 1997; but see Tokowicz & Kroll, 2007, for an alternative explanation). Using the distributed feature model as the framework, it is possible to generate specific predictions with regard to the strengths of the concreteness effects in bilingual versus monolingual learning. In monolinguals, presentation of a concrete word activates a wider lexical–semantic network than does the presentation of an abstract word (e.g., De Groot, 1989; Grondin et al., 2009; Schwanenflugel & Shoben, 1983), and the same is likely true for bilingual speakers. However, presentation of a concrete item in one of the bilinguals' two languages is likely to activate a wider lexical–semantic network than does the presentation of the same item to a monolingual, because in a bilingual, activation will include both the language in which the word was presented and the other language. Conversely, presentation of an abstract item in one of the bilingual's two languages is likely to activate a network similar to that in a monolingual speaker, since abstract translation equivalents do not overlap in the semantic network of a bilingual speaker to the same extent as concrete translation equivalents. If activation of the lexical–semantic system is stronger for concrete than for abstract words, and if bilinguals' lexical–semantic system is more robustly activated in response to the concrete words, then concreteness effects should be larger for bilingual than for monolingual learners.

Method

Participants

A group of 44 participants completed the study. Of these, 22 participants were monolingual native speakers of English who reported no significant knowledge of a second language (defined as self-ratings of second-language [L2] speaking proficiency of 2 or less on a scale from 0 [*no knowledge*] to 10 [*native-like knowledge*]), and 22 were English–Spanish bilinguals. The bilingual participants were carefully screened to ensure the following: English as the native language, self-rated average proficiency in Spanish of 7 or above (averaged across speaking and understanding ratings), and at least one immersion experience of at least 2 months in length in a Spanish-speaking country or family. Upon selection, bilingual participants were also administered a standardized receptive vocabulary test in Spanish in order to ensure adequate levels of Spanish knowledge. The demographic characteristics of the bilingual participants are reported in Table 1. All the demographic and language experience information was collected

Table 1 Spanish (L2) acquisition and L2 use data for bilingual participants (means and *SD*s)

L2 Data	Mean (*SD*)
Test de Vocabulario en Imagenes de Peabody (standard score)	113.30 (4.10)
Age of L2 acquisition	9.50 (4.80)
Degree of current L2 exposure	8.70 % (6.50)
Self-rated L2 proficiency: Speaking (0–10 scale)	7.50 (0.90)
Self-rated L2 proficiency: Understanding (0–10 scale)	8.10 (1.10)
Years of immersion in a Spanish-speaking country	1.50 (3.60)

using the Language Experience and Proficiency Questionnaire (Marian, Blumenfeld, & Kaushanskaya, 2007).

Although bilingual and monolingual participants were recruited from the same college-student population of the University of Wisconsin–Madison, the requirement for immersion experience in the bilingual group resulted in slightly unbalanced groups (see Table 2). Specifically, bilinguals were on average 1.87 years older than the monolinguals, with 1.64 more years of education. The two groups were matched in English receptive vocabulary skills and in verbal working memory skills. All participants were screened for nonverbal intelligence to ensure within-normal cognitive skills. Raw scores on the Kaufman Brief Intelligence Test–II were comparable between the two groups (p = .17). However, when raw scores were transformed into standard scores, the age difference between the two groups resulted in the hypercorrection of the bilinguals' scores. The result of this hypercorrection was a significant difference between bilinguals' and monolinguals' standard IQ scores.

Table 2 Monolingual and bilingual participants data (means and *SD*s)

	Monolinguals (n=22)	Bilinguals (n=22)	t Value
Age	20.07 (1.0)	21.94 (1.8)	4.34*
Years of education	14.6 (1.0)	16.3 (1.3)	4.37*
Peabody Picture Vocabulary Test–III (standard scores)	111.5 (4.4)	116.6 (13.3)	2.57
Woodcock Johnson Tests of Cognitive Abilities–II Numbers Reversed (standard scores)	109.8 (12.7)	113.8 (10.8)	1.11
Kaufman Brief Intelligence Test–II Visual Matrices (raw scores)	38.77 (0.72)	40.45 (0.95)	1.41
Kaufman Brief Intelligence Test–II Visual Matrices (standard scores)	103.45 (2.13)	111.55 (2.80)	2.27*

* Significant differences between monolinguals and bilinguals, $p < .05$.

Materials

Two lists of 12 novel words were selected from the Gupta et al. (2004) nonword database. All novel words were two syllables in length and followed the sound patterns of English (e.g., *gapume*, *botefe*). None of the novel words were real words in Spanish. The stimuli were matched across the two lists on syllable structure, in that all novel words were consonant–vowel–consonant–vowel–consonant pseudowords. The novel words across the two lists did not differ in duration [List A, M = 999.17 ms, SD = 69.05; List B, M = 1,015.67 ms, SD = 81.00; $t(11)$ = 0.62, p = .55], phonotactic probability [List A = 0.23, SD = 0.04; List B = 0.23, SD = 0.04; $t(11)$ = 0.33, p = .75], or biphone frequency [List A = 0.007, SD = 0.003; List B = 0.007, SD = 0.04; $t(11)$ = 0.62, p = .55]. The phonotactic and biphone frequency values were calculated using the phonotactic probability calculator (Vitevitch & Luce, 2004). The two lists of nonword stimuli can be found in supplementary materials for this article.

Each novel word was paired with an English word. One list of novel words was paired with concrete English nouns (e.g., *daisy*, *helmet*), and the other list of novel words was paired with abstract English nouns (e.g., *virtue*, *sorrow*). The pairing of novel-word lists with English noun lists (concrete vs. abstract) was counterbalanced across participants. Concreteness was determined using the MRC lexical database. Only nouns with concreteness ratings above 500 (on a scale from 100 to 700) were selected for the concrete list, and only nouns with concreteness ratings below 350 were selected for the abstract lists. The two lists of English words (concrete vs. abstract) differed significantly in their concreteness ratings (concrete, M = 588.67, SD = 24.60; abstract, M = 279.42, SD = 31.74) [$t(11)$ = 29.81, $p < .0001$]. However, the two lists of English words were matched on syllable length, frequency of use [concrete, M = 36.16, SD = 40.79; abstract, M = 37.50, SD = 43.39; $t(11)$ = 1.07, p = .31], phonotactic probability [concrete, M = 0.28, SD = 0.10; abstract, M = 0.30, SD = 0.13; $t(11)$ = 0.45, p = .66], biphone frequency [concrete, M = 0.02, SD = 0.01; abstract, M = 0.02, SD = 0.02; $t(11)$ = 0.49, p = .63], and number of lexical neighbors [concrete, M = 0.75, SD = 1.14; abstract, M = 1.00, SD = 2.59; $t(11)$ = 0.29, p = .77]. Frequency of use (per million) and neighborhood density values were calculated using CELEX (Baayen, Piepenbrock, & Gulikers, 1995).

The novel words and the English words were recorded by two different female speakers, both of whom were native speakers of American English. All stimuli were recorded in a soundproof booth at a 44-kH sampling rate and were normalized to 70-dB amplitude using Praat (Boersma & Weenink, 2007).

Procedure

Each participant completed the entire experiment in a single testing session. During the *learning* phase, novel words and their English translations were presented over computer speakers in a soundproof booth. The novel word was always presented first, followed by the English word. The presentation of concrete and abstract pairs was intermixed. Each pair was presented twice during the learning phase, with the order of presentation randomized for each participant. The interstimulus interval between the presentation of the novel word and its English translation was set to 750 ms, and the interval between presentations of the pairs was set to 3 s. Participants were instructed to memorize the association between the novel words and their English translations.

During the *testing* phase, participants were asked to produce the correct English translations for the novel words. Such translation-like tasks are common measures of associative learning (e.g., De Groot & Keijzer, 2000; Paivio & Yuille, 1969) and have frequently been used in previous studies of novel-word learning with both bilinguals and monolinguals (e.g., Kaushanskaya & Marian, 2009; Van Hell & Mahn, 1997). Each novel word was played over speakers, and the participants were instructed to produce the corresponding English translation into a microphone. The responses were recorded as sound files for later coding and analyses.

During the *standardized testing* phase, standardized language and intelligence tests were administered to each participant, including an English receptive vocabulary test (Peabody Picture Vocabulary Test–III), a nonverbal IQ test (Kaufman Brief Intelligence Test, Visual Matrices subtest), and a verbal working memory test (Numbers Reversed subtest of the Woodcock Johnson Tests of Cognitive Abilities–II). A measure of Spanish receptive vocabulary was administered to the bilingual speakers (Test de Vocabulario en Imágenes de Peabody).

Analyses

The production accuracy data (proportions correct) were normally distributed (Kolmogorov–Smirnov statistics < 0.15, $p > .1$), and therefore were analyzed using a 2 × 2 ANOVA, with group (monolingual vs. bilingual) and concreteness (concrete vs. abstract) as independent variables. Both by-subjects (F_1) and by-items (F_2) analyses are reported. Production reaction time (RT) data were also analyzed using a 2 × 2 ANOVA. RTs were measured from the onset of the novel word to the participant's buttonpress after production of the English translation. Only RTs for the correctly produced translations were included in the calculations of mean RTs. Years of education and standard scores on the nonverbal IQ measure were covaried out in all of the cross-group by-subjects analyses. Age was not covaried out, because it correlated highly with years of education.

Results

Accuracy analyses

The proportion correct data across groups and conditions are presented in Fig. 1. A 2 × 2 ANOVA revealed a main effect of concreteness [$F_1(1, 41) = 4.26$, $MSE = 0.05$, $p < .05$, $\eta_p^2 = .10$; $F_2(1, 22) = 17.37$, $MSE = 0.23$, $p < .0001$, $\eta_p^2 = .44$], with concrete referents ($M = .22$, $SE = .02$) retrieved more accurately than abstract referents ($M = .11$, $SE = .02$). The main effect of group was not significant in the by-subjects analysis [$F_1(1, 41) = 2.38$, $MSE = 0.02$, $p = .13$, $\eta_p^2 = .09$], but was significant in the by-items analysis [$F_2(1, 22) = 6.32$, $MSE = 0.04$, $p < .05$, $\eta_p^2 = .22$]. Bilinguals ($M = .19$, $SE = .02$) tended to outperform monolinguals ($M = .13$, $SE = .03$). Crucially, the interaction between concreteness and group was significant [$F_1(1, 41) = 5.01$, $p < .05$, $MSE = 0.06$, $\eta_p^2 = .12$; $F_2(1, 22) = 5.55$, $p < .05$, $MSE = 0.04$, $\eta_p^2 = .11$].

Follow-up univariate ANOVAs with group as the independent variable revealed that bilingual participants were more accurate than monolingual participants when retrieving *concrete* referents for the newly learned words [$F_1(1, 42) = 5.54$, $MSE = 0.10$, $p < .05$, $\eta_p^2 = .12$; $F_2(1, 11) = 4.91$, $MSE = 0.03$, $p < .05$, $\eta_p^2 = .31$]. However, bilinguals and monolinguals were similarly accurate when retrieving *abstract* referents for the newly learned words [$F_1(1, 42) = 0.19$, $MSE = 0.01$, $p = .67$, $\eta_p^2 = .02$; $F_2(1, 11) = 1.70$, $MSE = 0.01$, $p = .22$, $\eta_p^2 = .13$].

Follow-up repeated measures ANOVAs with concreteness as the independent variable were used to examine the strength of the concreteness effects within each group separately. These analyses revealed a significant concreteness effect in the bilingual group [$F_1(1, 21) = 21.51$, $MSE = 0.27$, $p < .001$, $\eta_p^2 = .51$; $F_2(1, 22) = 10.71$,

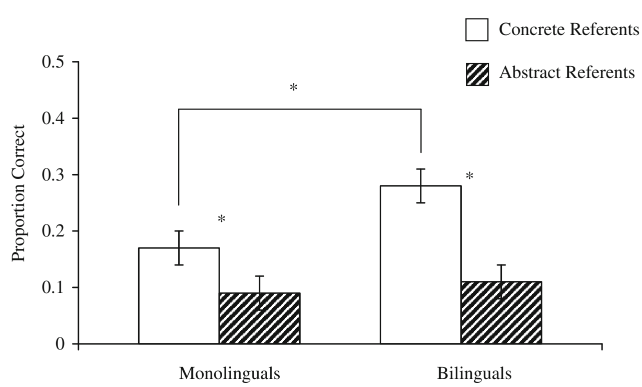

Fig. 1 Mean monolingual and bilingual translation accuracy (proportions correct) in the concrete-referent and abstract-referent conditions. The error bars represent standard deviations. $^*p < .05$

MSE = 0.15, $p < .01$, $\eta_p^2 = .33$] and in the monolingual group [$F_1(1, 21) = 8.57$, $MSE = 0.11$, $p < .01$, $\eta_p^2 = .29$; $F_2(1, 22) = 14.27$, $MSE = 0.09$, $p < .01$, $\eta_p^2 = .39$]. However, comparisons of the effect sizes in the by-subjects data revealed that the effect of concreteness was significantly stronger in the bilingual group than in the monolingual group, *z score = 12.96, p < .001.*

RT analyses

A 2 × 2 ANOVA revealed a marginally significant effect of concreteness in the by-subjects analyses [$F_1(1, 23) = 4.06$, MSE = 40,533,371.77, $p = .056$, $\eta_p^2 = .15$], but not in the by-items analyses [$F_2(1, 18) = 0.00$, $MSE = 0.13$, $p = .10$, $\eta_p^2 < .001$]. There was a tendency for concrete referents (M = 5,108.58, SE = 677.95) to be retrieved more quickly than abstract referents (M = 6,922.43, SE = 514.37). The main effect of group was not significant [$F_1(1, 23) = 0.29$, MSE = 2,242,493.76, $p = .60$, $\eta_p^2 = .01$; $F_2(1, 18) = 0.002$, MSE = 9,709.26, $p = .96$, $\eta_p^2 < .001$]. Moreover, the interaction between concreteness and group was also not significant [$F_1(1, 23) = 2.80$, MSE = 27,903,646.31, $p = .11$, $\eta_p^2 = .11$; $F_2(1, 18) = 2.75$, MSE = 11,677,855.14, $p = .12$, $\eta_p^2 = .13$].

Discussion

In the present study, we contrasted the learning of novel words in association with concrete versus abstract English translations in order to test the hypothesis that the bilingual advantages for novel-word learning may be based, at least in part, on bilinguals' sensitivity to the semantic information associated with the novel words. Prior extensive work on concreteness effects strongly supports semantic differences between abstract and concrete words (De Groot, 1989; Grondin et al., 2009; Paivio, 1986, 1991; Paivio et al., 1994; Schwanenflugel & Shoben, 1983), with concrete words activating a richer network of semantic information (e.g., mental imagery or a wider network of contextual information) than abstract words. Our finding of a stronger bilingual advantage for concrete than for abstract novel words suggests that the effects of bilingualism on word learning are more likely to emerge when semantic information associated with the novel words is more accessible. The lack of significant RT differences between bilinguals and monolinguals on the translation task indicates that bilinguals' more accurate translation performance was not a result of accuracy–RT trade-offs or of bilinguals' strategic allocation of time to the translation task.

What may explain the bilinguals' superior learning of concrete words? Consideration of concreteness effects in the monolingual group versus the bilingual group is helpful in informing this question. Although a main effect of concreteness was found, it is apparent that concreteness effects were stronger in the bilingual group than in the monolingual group. The difference between the concrete and abstract conditions in the bilingual group (mean difference = .17) was more than twice the size of the difference in the monolingual group (mean difference = .08). Previous work on the representations of concrete versus abstract words in the bilingual lexical–semantic system suggests that concrete translation pairs across bilinguals' two languages may share a larger semantic overlap than do abstract translation pairs (e.g., De Groot, 1992; Jin, 1990; Paivio & Desrochers, 1980; Van Hell & De Groot, 1998). Therefore, it is possible that concrete words cause a wider activation of the bilingual lexical–semantic system (vs. the monolingual system), thus yielding a stronger concreteness effect in bilinguals than in monolinguals. It may be that the same mechanism—namely, the structure of the bilingual (vs. the monolingual) lexical–semantic system—is what drove the stronger bilingual advantage for the concrete than for the abstract words. The English translations would have activated a wider lexical–semantic network in bilinguals than in monolinguals, since in bilinguals the activation would have involved both the activation of the English lexical–semantic network and the overlapping Spanish lexical–semantic network. This would result in more robust lexical–semantic activation in response to concrete words in bilinguals, thus yielding stronger learning. Conversely, abstract English translations would have activated similar lexical–semantic networks in bilinguals and in monolinguals, yielding comparable learning profiles in the two groups of learners.

Thus, it may be that sensitivity to semantic information during learning is a general property of the bilingual processing system, where through exposure to two languages, the bilingual's semantic system becomes more interactive, especially when confronted with concrete stimuli. That is, bilingual advantages for the learning of concrete words may stem not from different learning mechanisms in bilinguals versus monolinguals, but from the higher levels of semantic activation in the bilingual versus the monolingual lexical–semantic system, as a result of the availability of two languages. Thus, bilingual advantages for novel-word learning may be a natural outcome of how words are stored and processed in the bilingual versus the monolingual lexical–semantic system. This explanation of bilingual advantages on word-learning tasks is theoretically akin to Gollan and colleagues' (Gollan & Acenas, 2004; Gollan, Montoya, Fennema-Notestine, & Morris, 2005; Gollan & Silverberg, 2001) explanation of bilingual disadvantages on word-processing tasks. Gollan et al. have suggested that bilinguals' reduced lexical retrieval abilities are an outcome *not* of fundamental differences in language processing between bilinguals and monolinguals, but of the fact that bilinguals, by virtue of distributed lexical exposure, have weaker links between lexical and semantic representations. Here, it is possible that bilinguals' more efficient lexical learning is an outcome of a more resonant and interactive semantic system in bilinguals as a result of cross-linguistic coactivation.

The stronger effect of bilingualism on the learning of concrete (rather than abstract) novel words, although suggestive of a mechanism that underlies bilingual advantages for word-learning tasks, leaves open a number of additional possibilities as to the identity of this mechanism. For example, it is possible that bilinguals may benefit from concrete referents because they recognize that focusing on the words' meanings would be a successful strategy on this particular type of learning task, and thus they choose to consciously employ this strategy. It may be feasible in future studies to examine whether bilinguals' sensitivity to semantic information is an outcome of strategy use by instructing learners to use semantic versus rote (phonological) strategies when encoding novel words. If bilinguals are able to strategically allocate attention to the semantic information associated with the novel words, they should be particularly skilled at utilizing meaning-based strategies at learning, independent of the semantic content of the words (concrete or abstract). If, on the other hand, the interactivity of the bilingual lexical–semantic system is at the root of the bilingual advantages for learning concrete words, then manipulating learning strategy should not influence the patterns observed in the present study. That is, independent of how learners are instructed to learn, bilinguals would be expected to outperform monolinguals on the concrete but not on the abstract items.

The interpretation of the bilingual advantage for word learning observed in the present study must be qualified by the following considerations. First, this word-learning task is well practiced by experienced learners. In fact, Van Hell and Mahn (1997) demonstrated that experienced language learners (i.e., multilingual learners with large amounts of classroom-based language-learning experience) were especially successful at learning novel words via a paired-associates-learning-like method. Therefore, the finding of a bilingual advantage in the present study may apply only to bilinguals with vast amounts of L2 experience and to learning tasks of this particular kind. It is interesting to note that although our strict inclusion criteria for bilingual participants resulted in a homogeneous group of bilinguals with respect to their L2 proficiency, there was variability in the bilingual group with respect to the age at which the L2 was acquired. When bilingual participants' word-learning data were correlated with L2 age-of-acquisition data, inverse correlations were observed between age of acquisition and translation accuracy. The correlation was significant for abstract words ($r = -.45$, $p < .05$), but not for concrete words ($r = -.18$, $p = .42$). The fact that earlier exposure to the L2 was associated with better word-learning performance indicates that robust exposure to an L2 is likely to be crucial for the positive effects of bilingualism to emerge on learning tasks of the kind used in the present study. Second, the finding that the bilingual advantage for word-learning tasks is qualified by concreteness may be specific to retention measures that probe for the meanings associated with the novel words, as was the case in the present study. Therefore, it will be important to test both the retention of the novel word forms and of their meanings in the future. Third, although the translation accuracy rates in the present study were quite similar to those in other published accuracy data on translation-like tasks administered immediately after learning (e.g., Kaushanskaya, in press), they are suggestive of the high levels of difficulty associated with this particular learning task. Therefore, it is possible that bilingual advantages on learning tasks are especially likely to be observed when tasks are quite challenging.

In conclusion, the goal of the present work was to inform the search for the mechanisms that may underlie the effects of bilingualism on learning. We found that the bilingual advantage was stronger for concrete than for abstract novel words, and we ascribe this advantage to bilinguals' greater sensitivity to the semantic information associated with the novel words. It may be that the bilingual lexical–semantic system is more robustly activated in response to semantically rich material than is the monolingual lexical–semantic system, yielding stronger concreteness effects and better retention of concrete words in bilingual versus monolingual learners.

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