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## Semantic representations of new cognate vs. noncognate words: Evidence from two second language learning methods

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### Abstract

How is the new vocabulary connected with the semantic memory? Starting from the Revised Hierarchical Model (Kroll & Stewart, 1994), this study aimed to explore the links established between the new words and the conceptual system manipulating two learning methods and the type of word to be learned (cognate vs. noncognate). The data showed that the learning method and the type of words modulate the organization of bilingual memory.

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### Introduction

On second language acquisition (SLA) research, the way in which the words of the first (L1) and the second (L2) languages are connected to each other and to the conceptual system (CS) is a controversial issue. Kroll and Stewart (1994), for example, proposed a model, the Revised Hierarchical Model (RHM). This model regards bilingual memory organization as composed of three elements (L1 lexicon, L2 lexicon and the CS) whose relations to each other change in function of L2 proficiency (see Figure 1).

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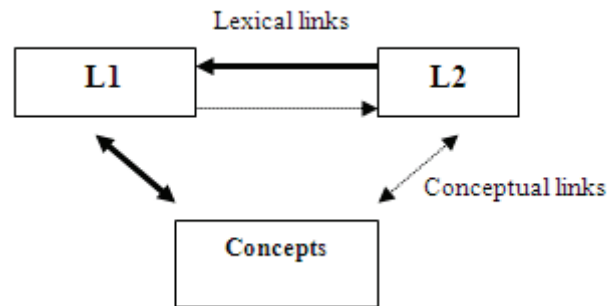


Fig. 1. Hierarchical Revised Model (adapted from Talamas, Kroll, & Dufour, 1999). The thin lines represent weak links.

The model states that in the early stages of new vocabulary acquisition (i.e., low levels of proficiency), the lexical links between L2-L1 words are stronger than the semantic links between L2 words and the CS, and as L2 proficiency increases the links between L2 words and the CS develop. Thus, proficient bilinguals show semantic links between L2 words and the CS as strong as those between the L1 words and the CS. One direct consequence of this is that, when processing L2 words, novice learners rely less on the stored information about the features and attributes that define concepts (CS) than the proficient ones. Consequently, in tasks that involve deciding whether an L2 word is or is not the correct translation of an L1 word, proficient bilinguals take more time and/or make more mistakes when they have to reject pairs that are semantically related [e.g., *alas*-*plane*] than when they are unrelated [e.g., *casa*-*plane*]; an empirical effect known as the semantic interference effect. Note that *alas* and *casa* are the Spanish words for wings and house, respectively.

However, although some studies seem to support the RHM assumptions (e.g., Kroll & Linck, 2007; Talamas et al., 1999), others showed that the direct access L2-CS can be observed in early stages of L2 acquisition not only with adults (e.g., Finkbeiner & Nicol, 2003), but also with children (Comesaña, Perea, Piñero, & Fraga, 2009). As a result of these conflicting data, Kroll et al. recognize that the type and the stability of L2-L1 links can be shaped by other variables like the learning method used in L2 words acquisition (e.g., Kroll, Michael, & Sankaranarayan, 1998) and/or the type of words to be learned (e.g., Tokowicz, Kroll, de Groot, & van Hell, 2002). This led to a fruitful development of research in literature that tries to clarify under what conditions the SLA is more effective.

Following Comesaña et al. (2009) study, the present work aims to explore, in the early stages of children's new vocabulary acquisition, the role of the learning method used (L2-L1 word method vs. L2 word-picture method) and the type of L2 words to be learned (cognate vs. noncognate words), in the kind of links established between L2 and the CS. Based on literature, we expect a larger semantic interference effect on the L2 word-picture method than on the L2-L1 word method, since in the L2 word-picture method children learn the new vocabulary associating each L2 word to a picture (instead of a L1 word like in the L2-L1 word method) which is expected to strengthen L2-CS connections. Moreover, a word type effect is expected. According to RHM, the learning of cognate words [equivalent translations with the same or a very similar form - e.g., *paper*(English)-*papel*(Spanish)] would be easier during the early stages of acquisition because novice learners rely more on the lexical links than on the conceptual ones. Thus, we expect that the L2-L1 word method will improve the learning of cognate words and the L2 word-picture method will improve the learning of noncognate words. Additionally, we also analyze the time stability of these results collecting data in two different moments (immediately after the acquisition phase vs. one week later). This could be important because the effect of the learning method may be more robust over time (Comesaña et al., 2009).

## 1. Experiment

### 1.1. Method

#### 1.1.1. Participants

Forty-two children (mean age=10.87; SD= 0.85) participated in the experiment. All were 6th graders recruited in private elementary schools from Northern Portugal. All participants were European Portuguese (EP) native speakers and had knowledge of other languages equivalent to their educational level. None of them had prior knowledge of Basque, the L2 used in this study.

### *1.1.2. Stimuli*

Forty-two high frequency Basque nouns were selected from the EuskalHitzak database (Perea et al., 2006). Each Basque word was paired with three types of EP words: (i) correct EP translation [e.g., zeru-céu(sky)]; (ii) semantically associated EP word [e.g., zeru-azul(blue)]; and (iii) unrelated EP word [e.g., zeru-pai(father)]. In the associated condition, 32 words were chosen from Albuquerque (2008) study and 10 from a preliminary study. In the unrelated condition, words were matched to the associated ones both in length (5.47 and 5.83 respectively), frequency (157.18 and 166.97) and familiarity (4.19 and 3.14) using EP lexical databases. In the correct EP translation condition, half of the words were cognate and the other half noncognate. The concreteness values of the EP words were 6.40, 5.65, and 5.24 to translations, associated and unrelated words, respectively. The word pairs were counterbalanced across three experimental lists.

### *1.1.3. Procedure*

The procedure mimicked the procedure used by Comesaña et al. (2009). Subjects carried out the acquisition phase to learn the 42 selected words. Half of the participants were randomly assigned to the L2-L1 learning method group and the other half to the L2-picture learning method group (see Comesaña et al., 2009, for more details). Then, children performed the backward translation recognition task individually in a quiet room. The presentation of the stimuli and the recording of response times and errors were controlled by a laptop. The procedure was created using the Superlab 4.0 software (Cedrus Corporation, 2006). On each trial, a fixation point (+) was presented for 1000 ms in the centre of the screen. A Basque word appeared for 250 ms, and it was immediately replaced by an EP word until the participant's response or after 2500 ms. Participants had to decide as rapidly and accurately as possible, whether the second word was the correct translation or not of the first word presented (pressing two different buttons for each case). Prior to the experimental trials, the participants saw six practice trials. One week later the children repeated the test phase.

## **2. Results**

The Table 1 presents the mean response latencies (TRs) of the correct participant's answers and the percentage of errors to the backward translation recognition task performed immediately after the acquisition phase and one week later.

**Table 1. Mean response latencies (in ms), standard deviations (in parentheses), and percentage of errors by training method, type of words, prime-target relations and test time**

Training Method	Type of words		Type of Relation					
			Translation Immediate	Related Immediate	Unrelated Immediate	Translation delayed	Related delayed	Unrelated delayed
L2-L1 Group	Cognates	RTs	831 (247)	1051 (251)	1033 (279)	786 (161)	975 (206)	955 (244)
		%E	8.7 (15.5)	19.8 (22.1)	4.8 (9.3)	2.4 (6)	15.1 (16.6)	1.6 (5)
	Noncognates	RTs	1046 (261)	1026 (237)	1110 (328)	1075 (297)	953 (233)	989 (247)
		%E	15.9 (15.3)	15.1 (16.6)	9.5 (12.4)	23 (17.9)	11.9 (12.6)	7.1 (12.4)
L2-pictures Group	Cognates	RTs	794 (204)	1159 (348)	1080 (329)	782 (209)	971 (282)	966 (235)
		%E	8.4 (11.3)	15.1 (21.7)	4.8 (11.9)	13.5 (15.5)	26.2 (24.5)	6.3 (12.3)
	Noncognates	RTs	1017 (309)	1089 (290)	1139 (329)	1097 (375)	1038 (285)	1020 (284)
		%E	11.9 (14.1)	15.1 (18.2)	11.9 (15.9)	39.4 (21)	19 (31.1)	15.9 (15.3)

Repeated-measures analyses of variance for the TR of the correct responses and for the percentage error by subjects (F1) and by items (F2) were conducted based on a 2 (Prime-target relation: associated vs. unrelated) x 2 (Type of words: cognates vs. noncognates) x 2 (Training method: L2-L1 and L2-pictures methods) x 2 (Time of test: immediate, delayed) x 3 (List: list 1, 2 and 3) mixed design. The dummy factor List was included in the analyses to exclude the variance of error due to the lists. Note that on the prime-target relation we only consider two of the three experimental conditions (when the subjects had to respond “no”) because the critical question was to examine the presence of the semantic interference effect (i.e., the difference between the semantically related foils and the unrelated ones). Only results that reached or approached significance were presented.

The ANOVAs results for the TRs showed that the responses in the first time were slower than the responses in the second time:  $F_1(1,36) = 8.91$ ;  $p = .005$ ;  $\eta^2 = .20$ ;  $F_2(1,30) = 43.6$ ;  $p < .001$ ;  $\eta^2 = .59$ , and that the responses in the L2-L1 Group were faster than in the L2-picture Group:  $F_2(1,30) = 34.05$ ;  $p < .001$ ;  $\eta^2 = .53$ . Prime-target x Type word interaction effect was also significant:  $F_1(1,36) = 6.4$ ;  $p < .05$ ;  $\eta^2 = .15$ . This result indicated slower responses to noncognates unrelated pairs than to related ones:  $t_1(1,41) = 1.95$ ;  $p = .058$ , and slower responses to noncognate unrelated pairs than to cognates unrelated ones:  $t_1(1,41) = 2.7$ ;  $p = .010$ .

Error analyses showed that participants made more errors to semantically related pairs than to unrelated pairs:  $F_1(1,36) = 20.97$ ;  $p < .001$ ;  $\eta^2 = .37$ ;  $F_2(1,30) = 12.8$ ;  $p < .001$ ;  $\eta^2 = .3$ , and that the percentage of errors was higher for the L2-pictures Group than for the L2-L1 Group:  $F_2(1,30) = 8.6$ ;  $p < .05$ ;  $\eta^2 = .22$ . Furthermore, a larger interference effect in the delayed test was observed than in the immediate test:  $F_1(1,36) = 8.8$ ;  $p < .05$ ;  $\eta^2 = .20$ . The interaction Type of words x Training method effect was also significant:  $F_1(1,36) = 4.4$ ;  $p < .05$ ;  $\eta^2 = .11$ . Subjects in the L2-picture Group made more errors to noncognate pairs than subjects in the L2-L1 Group:  $t_1(1,40) = 1.4$ ;  $p = .016$ , and besides they made more errors to noncognate pairs than to cognate ones:  $t_1(1,20) = 1.1$ ;  $p = .03$ . It should also be noted that a three-way Prime-target relation x Type of words x Training method interaction effect approached significance in the analysis by subjects:  $F_1(1,36) = 3.12$ ;  $p = .08$ ;  $\eta^2 = .10$ . This result showed that for the L2-L1 training group, the interference effect was significant for cognate pairs:  $t_1(1,20) = 3.6$ ;  $p = .002$ , and approached significance for noncognate pairs:  $t_1(1,20) = 1.9$ ;  $p = .07$ . In contrast, for the L2-picture Group, the interference effect was only significant for cognate pairs:  $t_1(1,20) = 3.3$ ;  $p = .004$ . Moreover, for both training methods, the percentage of errors was higher to noncognate unrelated pairs than to cognate unrelated ones:  $t_1(1,20) = 2.9$ ;  $p = .009$  for the L2-L1 Group and  $t_1(1,20) = 2.7$ ;  $p = .014$  for the L2-pictures one.

### 3. Discussion

This study showed, like Comesaña (2007) and Comesaña et al. (2009) studies, a clear semantic interference effect in the early phases of new vocabulary acquisition with children (i.e., more errors to related pairs than to unrelated ones) in a translation recognition task even after a single-session of learning. More importantly, the training method appeared to have an impact in the processing of cognate and noncognate words and on the magnitude of the semantic interference effect, although in the opposite direction than expected.

In fact, only the participants from the L2-L1 Group showed a semantic interference effect independently of the type of words (cognates vs. noncognates). Although it is important to note that the interference effect to noncognate pairs only approached the significance ( $p = .07$ ). The semantic interference effect to the children from the L2-pictures Group merely appeared with cognate words. Although these results seem to suggest that the L2-L1 words method strengthened the links between the L2-CS more than the L2 word-picture method, we consider that they could be explained by an access to the CS via the activation of the L1 translation equivalents. Actually, the inclusion of cognate words might lead children to adopt a strategy based on the orthographic and phonological similarity between words independently of the training method used. So, the inclusion of cognate and noncognate words in the same task could, inadvertently, stimulate the activation of L1. In fact, it is already established that the activation of equivalents translation is an automatic and unconscious process (Thierry & Wu, 2007). Thus, the better performance of L2-L1 Group could be explained simply because the mode of testing matches the mode of learning (see Jones, 2004). Therefore, the crucial question is to know which is the best way to reduce or control the activation of the L1 even in the presence of cognate words.

In sum, our results seem to be congruent with the assumption of the RHM, indicating that: a) the semantic processing of new words in novice learners is mediated by the lexical representations of L1 and, only under certain circumstances, the type of links established between L2 and the CS can be modulated (Kroll & Linck, 2007), and b) the cognate words were easier to learn than noncognate words because of the stronger lexical links. Future studies with children and adults using different tasks are needed in order to assess, in a more specific way, the role of the training method in the new vocabulary acquisition when the words are of different type. Assessing when and under what conditions a training method is more effective is crucial to understanding the architecture and functioning of bilingual memory, with obvious implications for the educational area. The replication of the present work with languages that do not have the same orthography would be interesting, because it would lead us to explore the role of the phonological overlap in the direct semantic access from L2.

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