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Learning in Spanish and English: Language-Dependent Memory in Bilinguals

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Abstract

The academic and cognitive performance of bilingual students may be impacted by their linguistic background and the relationship between language and learning. Previous investigations of bilingual episodic memory support the hypothesis of language-dependent memory, suggesting that memories become more accessible when the language of retrieval matches the language of encoding. The present study examined the effect of language on semantic memory by testing learning in fluent bilingual speakers of Chilean Spanish and English. Academic-type information was taught in either Spanish or English and memory was tested in the two languages. Participants produced more correct responses and responded faster when the language of retrieval matched the language of encoding than when the two did not match. Proficiency understanding and speaking English influenced participants' ability to encode and retrieve new information. These findings support the idea that reinstating the linguistic environment present at encoding at the time of retrieval facilitates memory for semantic and lexical information in bilinguals and underscore the need for sensitivity to linguistic background and contexts when testing cognitive abilities of bilinguals.

Keywords:
Language, Learning, Encoding, Retrieval, Bilinguals

Since the encoding specificity principle was first introduced a quarter of a century ago (Tulving & Thomson, 1973), cognitive psychologists have investigated context-dependent memory in a number of domains. Memory retrieval has been found to vary with environmental context (e.g., Smith, 1988), with mood and internal context (e.g., Bower, 1981), and with mental reinstatement of context (e.g., Geiselman, 1988) (see Davies & Thomson, 1988, for a review). Marian and Neisser (2000) proposed that linguistic context may lead to similar effects.

Although a number of different approaches might be used to study language-dependent recall, bilinguals provide a particularly fertile ground for studying language dependency effects in cognitive processing. Bilinguals encode some information while using one language and some while using another, and the drastic differences between the two linguistic environments may be particularly conducive to linguistic context effects. If language is a key factor in encoding, then language of retrieval should affect the accessibility of a bilingual individual's memories. Indeed, Marian and Neisser (2000) found that autobiographical memories of Russian-English bilinguals were more accessible when language at retrieval matched language at encoding than when it did not match. This finding is consistent with other results reported in the autobiographical memory literature, including autobiographical memory retrieval in bilinguals during psychoanalysis (e.g., Javier, Barroso & Muñoz, 1993), studies focusing on bilinguals who underwent a cultural transition (e.g., Otoya, 1987), and studies with bilingual elderly (e.g., Schrauf & Rubin, 1998). Further support for linguistic context effects is found in recent evidence that bilinguals exhibit more intense emotion when the language at retrieval matches the language at encoding than when it does not match (e.g., Marian, Kaushanskaya & Fausey, 2003).

The present project investigates whether language-dependent memory will manifest itself beyond autobiographical recall, namely, in semantic and lexical memory. Practically, a language-dependent memory pattern may serve as a partial explanation for the lower academic achievement reported for Hispanic students in US American schools (e.g., Coltrane, 2002; Llagas, 2003). Theoretically, it may support a "thinking-for-speaking" relationship between language and memory (e.g., Slobin, 2003) and may inform debates about the nature of semantic knowledge in bilinguals (e.g., Spelke & Tsivkin, 2001), with some types of knowledge possibly more susceptible to language-dependency effects than others. Our study aimed to answer the question: Is recall of semantic and lexical information more accurate, and/or faster, when the language of testing matches the language in which the information was learned?

Method

Participants

Twenty-six Chilean Spanish-English bilinguals (11 males, 15 females) were tested. Their mean age was 22 years old (SD=3.05 yrs). All participants lived in a Spanish-speaking country (Chile) at the time of testing. Two participants guessed the hypothesis of the study and were excluded from

analyses. Self-reported proficiency measures (5=high and 1=low) revealed higher levels of proficiency understanding Spanish (M=4.88, SD=0.34) than English (M=4.33, SD=0.56), $t(23)=4.03$, $p=.0005$ and higher levels of proficiency speaking Spanish (M=4.79, SD=0.41) than English (M=4.04, SD=0.91), $t(23)=3.42$, $p=.002$. Ratings of English speaking proficiency (M=3.63, SD=1.06), coded by an independent native English speaker, confirmed this difference, $t(23)=4.61$, $p=.0001$.

Materials

Four short, fictitious stories (Chemistry, Mythology, Biology, History), and corresponding sets of 12 questions per story (10 semantic, two lexical) were created (see Appendix for examples). The mythology story described the myth associated with celebrating the beginning of winter in a fictitious society. The history story described the causes, course and consequences of a war between two fictitious nations. The chemistry story described the accidental discovery and properties of a fictitious chemical element. The biology story described the flora of a fictitious island. Semantic questions tested concepts important to the story (e.g., Q: Why is the Fimo flag white and yellow? A: Because those are the colors of flowers on plants that are safe to eat.) and lexical questions tested names of characters or locations central to the story (e.g., Q: What is the name of the island where rare types of plants grow for part of the year? A: Fimo.).

All materials had both an English and a Spanish version. Materials were originally written in English, then translated to Spanish, and Spanish materials were checked and backtranslated into English by three native Chilean Spanish speakers. All stories and questions were presented as audio recordings. A native Chilean Spanish-English bilingual, judged by eleven independent English monolinguals to have minimal accent in English, read all materials for the recordings.

Design

A 2 x 2 x 2, Encoding Language (Spanish, English) by Retrieval Language (Spanish, English) by Information Status (Semantic, Lexical), within-subjects factorial design was employed. Participants listened to four stories, two in Spanish and two in English. Language and story order were counterbalanced across participants. After listening to the stories, participants answered 24 questions in English and 24 questions in Spanish, again counterbalanced across participants for language and story order. Each set of 24 questions consisted of six questions from each of the stories; thus, half of the questions

matched the language in which the story was read and half of the questions did not match the story language.

Procedure

All stories were presented through headphones on a Dell Inspiron 5000 laptop, using Windows Media Player. Participants listened to two stories in one language, completed a short, timed puzzle, listened to two stories in the other language, and completed another short, timed puzzle. Participants then answered 24 questions in one language, completed a short, timed puzzle, and answered 24 questions in the other language. Participants were queried about the purpose of the study and then completed the Language Experience and Bilingual Status Questionnaire (LEABS-Q, Marian, Blumenfeld, Garstecki, Kaushanskaya, Fausey, & Lu, 2003).

Coding

Response accuracy and latency were compared across each of the four encoding language by retrieval language conditions (Spanish encoding-Spanish retrieval, Spanish encoding-English retrieval, English encoding-Spanish retrieval, and English encoding-English retrieval). The mean percentage of correct answers and the mean response latency (ms) of correct answers were calculated for each participant. A second independent coder coded 10% of all data for reliability purposes; point-to-point agreement between the two coders was 94%.

Results

Response Accuracy

Response Accuracy results are shown in Figure 1. A 2 (Language of Encoding: Spanish, English) x 2 (Language of Retrieval: Spanish, English) x 2 (Information Status: Semantic, Lexical) Analysis of Covariance (ANCOVA), with proficiency understanding English as a covariate, revealed that the interaction between the language of encoding and the language of retrieval was significant, $F(1,22)=6.24$, $p=0.02$. Participants showed increased accuracy when the language of encoding and the language of retrieval matched ($M=0.48$, $SE=0.04$) than when they did not match ($M=0.45$, $SE=0.04$). The ANCOVA also revealed a marginal main effect of information status, such that participants showed increased accuracy when questions probed semantic information ($M=0.61$, $SE=0.03$) than when they probed lexical information ($M=0.32$, $SE=0.04$), $F(1,22)=3.87$, $p=0.06$.

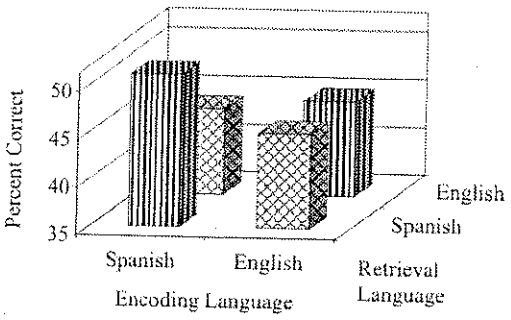

Figure1. Response Accuracy.

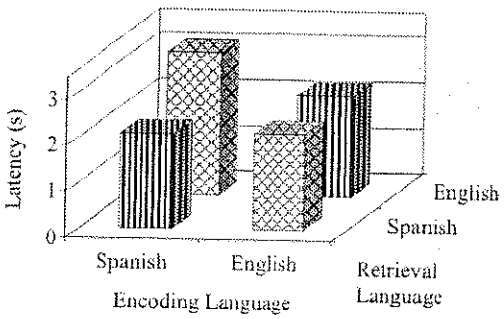

Figure 2. Responce Latency

Response Latency

Response Latency results are shown in Figure 2. Due to missing values in the repeated measures analysis for lexical answers, only semantic answers were considered. A 2 (Language of Encoding: Spanish, English) x 2 (Language of Retrieval: Spanish, English) ANCOVA, with proficiency speaking English as a covariate, revealed that the interaction between the language of encoding and the language of retrieval was significant, $F(1,22)=4.51$, $p=0.05$. Participants were faster to respond when the language of encoding and the language of retrieval matched ($M=2.13$, $SE=0.23$) than when they did not match ($M=2.59$, $SE=0.27$). The ANCOVA also revealed a main effect of the language of retrieval and a main effect of the language of encoding, such that participants were faster to respond when the language of retrieval was Spanish ($M=2.08$, $SE=0.15$) than when the language of retrieval was English ($M=2.64$, $SE=0.27$), $F(1,22)=8.56$, $p=0.008$, and faster to respond when the language of encoding was English ($M=2.14$, $SE=0.18$) than when the language of encoding was Spanish ($M=2.58$, $SE=0.23$), $F(1,22) = 12.05$, $p=0.002$.

Discussion

Spanish-English bilinguals remembered semantic and lexical information more accurately when the language of encoding and the language of retrieval matched than when they did not match. Additionally, bilinguals remembered correct semantic information faster when the languages of encoding and retrieval matched than when they did not match. Our work provides further evidence that reinstating the linguistic environment present at encoding at the time of retrieval facilitates memory in bilinguals. These findings are consistent with Marian and Neisser (2000) and Marian, Kaushanskaya and

Fausey (2003), extending the language-dependent memory effect from autobiographical memory to memory for semantic and lexical information.

This research highlights the importance of sensitivity to linguistic contexts in bilingual education. Our findings may serve as a partial explanation for the lower academic achievement reported for Hispanic students tested in English classrooms (e.g., Llagas, 2003), who are likely to have encoded at least some of their memories in Spanish (e.g., at home). We reiterate that care should be taken to include awareness of the effects of test language on performance when teachers and clinicians assess cognitive abilities of bilinguals.

References

Bower, G.H. (1981). Mood and memory. American Psychologist, 36(2), 129-148.

Coltrane, B. (2002). English Language Learners and High Stakes Tests: An Overview of the Issues. ERIC Digest. htttp://www.cal.org.ericcll/DIGEST.

Davies, G.M., & Thomson, D.M. (Eds.). (1988). Memory in Context: Context in Memory. Chichester, U.K.: Wiley & Sons.

Geiselman, R.E. (1988). Improving eyewitness memory through mental reinstatement of context. In G.M. Davies & D.M. Thomson (Eds.), Memory in Context: Context in Memory (pp. 245-266). Chichester, U.K.: Wiley & Sons.

Javier, R.A., Barroso, F., & Muñoz, M.A. (1993). Autobiographical memory in bilinguals. Journal of Psycholinguistic Research, 18, 449-472.

Llagas, C. (2003). Status and trends in the education of hispanics. nces.edu.gov/pubs2003/hispanics.

Marian, V., Kaushanskaya, M., & Fausey, C. (2003, April). Autobiographical narratives and the self in bicultural bilinguals. Paper presented at the Fourth International Symposium on Bilingualism, Tempe, AZ.

Marian, V., Blumenfeld, H., Garstecki, D., Kaushanskaya, M., Fausey, C., & Lu, D. (2003, May). Developing a tool for assessing Language Experience And Bilingual Status (LEABS). Poster presented at the annual meeting of the Midwestern Psychological Association, Chicago, IL.

Marian, V., & Neisser, U. (2000). Language-dependent recall of autobiographical memories. Journal of Experimental Psychology: General, 129(3), 361-368.

Otoya, M.T. (1987). A study of personal memories of bilinguals: The role of culture and language in memory encoding and recall. Unpublished doctoral dissertation, Harvard University.

Schrauf, R.W. & Rubin, D.C. (1998). Bilingual autobiographical memory in older adult immigrants: A test of cognitive explanations of the reminiscence bump and the linguistic encoding of memories. Journal of Memory and Language, 39, 437-457.

Slobin, D.I. (2003). Language and thought online: Cognitive consequences of linguistic relativity. In D. Gentner & S. Goldin-Meadow (Eds.), Language in mind: Advances in the study of language and thought (pp. 157-191). Cambridge, MA: MIT Press.

Smith, S.M. (1988). Environmental context-dependent memory. In G.M. Davies and D.M. Thomson (Eds.), Memory in Context: Context in Memory (pp. 13-34). Chichester, U.K.: Wiley & Sons.

Spelke, E., & Tsivkin, S. (2001). Language and number: A bilingual training study. Cognition, 78, 45-88.

Tulving, E., & Thomson, D. (1973). Encoding specificity and retrieval processes in episodic memory. Psychological Review, 80 (3), 352-373.

Appendix

Example Story and Questions

Mythology Story

The following story is a famous myth of the Espibi people. All the Espibis know this story well because it is told every year on the holiday that celebrates the beginning of winter. On the morning of the first day of winter, while people are sleeping, a bolt of lightening comes from the sky, accompanied by a strong gust of wind. This bolt of lightening starts the winter season and is unique because it is a special shade of red. This red colors the wind as well and for several hours everything touched by this wind becomes red. This red color of the wind is recognized by certain animals called Begus. Begus are small animals who cannot be seen by humans and they only live in trees that have leaves. Begus must live among things that will eventually fall but have not fallen yet. They can't survive when all the leaves of the trees are gone, so they need a signal to leave their homes before all the leaves fall. Their signal to leave is the red wind on the first day of winter. When they see the red wind, they start running to keep up with it. As more and more run, they all become red and run even faster. The red lightening bolt that started winter gives its energy to the wind and the wind gives this energy to the Begus to help them run extremely fast. Running so fast lifts them off the ground and for a special moment a red line

can be seen leading to the sky. It is the path of the Begus leaving their homes on earth to build a home in clouds. Clouds are good homes for Begus because, like trees, they are filled with things that will fall but haven't fallen yet. As all the Espibi people know, the special thing about winter is snow. They believe that snow is so beautiful because the Begus work hard to cover the land in beauty. They want to make the land beautiful because they are so grateful to have a place to live after they have to leave their trees. To celebrate the beginning of winter, Espibis decorate their home with red clouds. You know it's winter when the windows and doors of every house have red clouds on them. Snow and clouds hold a special place in the hearts of Espibi people, and if anyone ever looks to the sky and sees a red cloud, he knows that a Begu was thinking of him that day, and he will be blessed with very good luck.

Mythology Questions Group 1

1. In the story about a myth and celebrations, what is the name of the people who celebrate the beginning of winter? (lexical)
2. Why do Espibis know their myth about the beginning of winter so well?
3. How do Espibis celebrate the beginning of winter?
4. What natural event starts winter, according to an Espibi myth?
5. What can Espibis see during a special moment on the first day of winter?
6. During winter, what is a sign of good luck to the Espibis?

Mythology Questions Group 2

7. In the story about a myth and celebrations, what is the name of the animals who can see wind on the first day of winter? (lexical)
8. What do Begus recognize that tells them to leave their trees?
9. Why are trees and clouds good places for Begus to live?
10. What do Begus do when they see the red wind and decide they need to leave their trees?
11. What is the original source of the Begus' energy?
12. Why do Begus make beautiful snow, according to this winter myth?

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