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ARTICLES

Syntactic Comprehension, Verbal Memory, and Calculation Abilities in Spanish–English Bilinguals

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This article analyzes the interfering effect of the second language (L2) on the first language (L1) in native Spanish speakers living in the United States. We examined 3 linguistic aspects: (a) syntactic comprehension, (b) verbal memory, and (c) calculation abilities. We carried out 2 different studies. In the 1st study, we studied syntactic understanding in 50 Spanish–English bilinguals. For all participants, L1 was Spanish and L2 was English, and all learned English early in life and had attended English schools. Results for the Spanish Syntactic Comprehension Test (Marcos & Ostrosky, 1995) were compared with the normative results obtained with 40 Spanish monolingual participants. We observed that the closer to the English syntax the sentences were, the easier it was for the participants to understand them. Participants who had been exposed to English between the ages of 5 and 12 outperformed participants exposed to English before 5 years of age. Language preference correlated with syntactic comprehension. Women outperformed men. In the 2nd study, verbal memory and calculation abilities were examined in L1 and L2 in a group of 85 Spanish–English bilinguals. Parallel versions of the different tests were administered in Spanish and English. The results indicated some significant differences between the 2 languages in several verbal learning and calculation ability subtests. Most of the verbal memory subtests were better performed in L1. Scores on tasks measuring speed and calculation accuracy were higher in the participant's native language. Best spoken language proved to be a significant variable in some verbal memory subtests performed in English but not in Spanish. We analyze implications of bilingualism in neuropsychological testing. We also present some suggestions to minimize the bilingualism effect.

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Bilingualism is not an unusual phenomenon. More than half of the world's population is bilingual or multilingual at some level of proficiency. Bilinguals and multilinguals, however, represent an extremely heterogeneous population. They can vary along a significant number of dimensions, including (a) sociolinguistic background, (b) type of bilingualism, (c) degree of proficiency, (d) age and sequence of acquisition of the languages, (e) method of acquisition of the second language (L2), (f) language-specific factors, and (g) anatomical dimensions (Dupont, Ardila, Rosselli, & Puente, 1992). Although there is extensive research on bilingualism, bilingualism in many regards remains a poorly understood phenomenon.

Spanish–English bilingualism in the United States has been the center of interest from different perspectives, ranging from the linguistic to the political sphere. The Hispanic population represents about 10% of the general population. When one takes into account not only the significant number of Spanish speakers but also the fact that there is one Spanish-speaking U.S. associate state (Puerto Rico), the United States can be regarded, to a certain extent, as a Latin American country. However, Spanish is not socially, academically, economically, and politically equivalent to English, and frequently it is maintained as a marginal language. Native Spanish speakers are usually required to speak English at work and in general everyday activities. Children attend English-speaking schools. Spanish books in the United States are very limited, and in general, cultural activities in Spanish are scarce. Some interference from English to Spanish may be conjectured. Furthermore, in this particular context, Spanish–English bilingualism represents an active bilingualsm (i.e., both languages are used in everyday life), and in consequence, not only interference but also mixture can be anticipated.

Interference from the first language (L1) to L2 is a well-established observation in bilinguals (e.g., Bahrick, Hall, Goggin, & Bahrick, 1994; Dongryong, 1990; Dupont et al., 1992). Nonetheless, interference from L2 to L1 is rarely mentioned in bilingualism literature. It is an intuitive observation that L1 tends to deteriorate when the speaker is exposed to an alien linguistic environment. Everyday observation illustrates that Spanish speakers living for some time in the United States frequently present difficulties in using Spanish orthography, minor phonetic abnormalities may be observed in some phoneme productions (most frequently, /r/, /p/, /l/, and /t/), and Spanish verbal fluency decreases (Rosselli et al., 1998). Even morphological and semantic abnormalities can be observed. This deleterious effect from L2 to L1 has been usually overlooked and evidently deserves much more attention. This article analyzes the interference from L2 to L1 in native Spanish speakers living in the United States. Three linguistic aspects are approached: (a) syntactic comprehension, (b) verbal memory, and (c) calculation abilities. Understanding linguistic characteristics of Hispanic populations may be extremely important in psychological and neuropsychological evaluation of U.S. Spanish speakers.

Each language has its own syntactic idiosyncrasies. In contrast to English, which is a strong word-order language with relatively weak morphology, Spanish, like Italian and other Latin languages, is a weak word-order language with a rich morphological system. Spanish syntactic rules allow for various displacements of the constituents of a sentence without modifying its essential meaning (Seco, 1980). For example, the sentence "John loves Mary" can be expressed in six different ways: "*Juan ama a María*," "*Juan a María ama*," "*A María ama Juan*," "*A María Juan ama*," "*Ama Juan a María*," and "*Ama a María Juan.*" In English (as in many other languages), if the sentence does not have a passive form or subordinate clauses, the canonical order is the only one permitted.

It has been observed that, in English, Italian, and German, the subject–verb–object (S–V–O) word order is the canonical one (Bates, Friederici, & Wulfeck, 1987). However, in Japanese, the canonical order is S–O–V (Hagiwara & Caplan, 1990). In Spanish, although the canonical order is also S–V–O, canonicity seems to be related to the distance between the nouns (Ns) and the V (Marcos & Ostrosky, 1995). The N that appears after the V (N–V–N) is considered as the one that receives the action, thus becoming the O of the sentence, whereas the N that is left is given the role of agent (A). Thus, in Spanish, due to its flexibility in the position of the elements, the canonical order seems to be related to the V–O structure: The N that follows the V is the O; this is the most reliable cue to grammatical roles. Thus, once the O is identified, the N that is left is given the role of A.

Marcos and Ostrosky (1995) observed that, in the interpretation of sentences, normal participants followed different strategies. The first depends on a

grammatical knowledge of the function of the preposition *a* (*to*) as a sign of the direct O. Further, the authors observed a tendency to interpret the nominal phrase that precedes the transitive V as the S (A) and the one that appears immediately after the V as the O. For example, in sentences such as "*Un león golpeó un tigre*" ("A lion hit a tiger"), the tiger is given the role of the O because it is placed immediately after the V, whereas the lion is assigned the role of A. However, when the syntactic ambiguity of this sentence becomes apparent and the elements that compose it are moved (e.g., "*Golpeó un león un tigre*"), the role of O is usually assigned to the lion because of its position following the V. This differs from the descriptions made in other languages such as English (Bates, Friederici, Wulfeck, & Juarez, 1988; Caplan & Futter, 1986; Wulfeck, Bates, & Capasso, 1991). When the preposition is lacking or when the order does not correspond to canonical order in Spanish (S–V–O), other cues are observed for understanding. Among these other strategies is the use of articles to mark the A or patient. When presenting an N in a sentence preceded by the definite article *el* (*the*) or the indefinite article *un* (*a*), different information about the N is being provided for assigning thematic roles. The different strategies interact very peculiarly and consistently.

Bilinguals, and particularly balanced bilinguals, are required to simultaneously rely on two different morphosyntactic systems. A certain degree of interference may be anticipated. Furthermore, it might be assumed that difficulties in complex syntactic comprehension should be evident in those syntactic principles separating the two languages. It can be predicted that Spanish–English bilinguals may prefer the canonical order when speaking Spanish. Moreover, they may face some difficulties in understanding Spanish noncanonical word order as a result of the English influence. We selected a bilingual Spanish–English sample and analyzed syntactic understanding in Spanish in the first study reported in this article.

Verbal memory in bilinguals has been the focus of interest of several research studies (Peynircioglu & Durgunoglu, 1993); however, the results have been mixed. Sometimes performance in memory tasks is similar in both languages, sometimes bilinguals seem to be at a disadvantage, and sometimes bilinguals appear to be at an advantage (Magiste, 1980; Ransdell & Fischer, 1987; Snodgrass, 1984). Peynircioglu and Durgunoglu suggested that, depending on the specific context of the memory task performed, bilingualism may increase or decrease performance and that a simple and unidirectional effect may not be expected.

Theoretical discussions have debated the existence of two separate storing places versus one integrated storing place in the bilingual person's memory (Hummel, 1986; McCormack, 1976; Paradis, 1993). Differences may involve the encoding and retrieval systems used in tasks performed in both languages (Durgunoglu & Roediger, 1987). Because of the heterogeneity of bilingual populations, results may vary between these two systems based on the bilingual sample that is selected.

Paivio and Lambert (1981) predicted and found that words coded bilingually were retained better than words coded unilingually. They suggested that the bilingual's processing is composed of translation, which is a deeper and more intense encoding and decoding than that involved in encoding one language. McCormack (1976) argued that verbal memory, as other aspects of memory, may include a significantly high number of attributes, such as speaker's voice, spatial position, and orthography. Kolers (1978, 1979) hypothesized that knowledge is organized according to the means and procedures by which it was acquired and forms part of our memory. He concluded that the organization of knowledge and memory are language dependent.

Few studies have approached the question of verbal memory in Spanish–English bilinguals. Harris, Cullum, and Puente (1995) developed equivalent list-learning tests in Spanish and English and administered them to three different groups of participants: monolingual English, balanced Spanish–English bilinguals, and nonbalanced Spanish–English bilinguals. They observed that nonbalanced bilinguals assessed in English learned fewer words overall and demonstrated lower retention scores compared to monolinguals. Comparisons of groups assessed in their dominant languages (Spanish or English) revealed no significant differences on verbal memory performance.

The second study presented in this article continued the analysis of verbal memory in Spanish–English bilinguals. The ability to perform calculation tasks in Spanish and English was further analyzed. It was hypothesized that (a) verbal memory and calculation tasks would be better performed in L1 than in L2, and (b) when similar syntactic structures between L1 and L2 were used, syntactic understanding would be higher.

Study 1

Method

Participants. Fifty middle socioeconomic status Spanish–English bilinguals (18 men and 32 women; age M = 28.7 years, SD = 7.1) with a minimum of 12

years of schooling were selected. In addition to gathering the general demographic data, we gave each participant a special questionnaire to assess the characteristics of their bilingualism. For all the participants, L1 was Spanish and L2 was English, and all learned English early in life and had attended English schools. Frequently, they mastered English better than Spanish. Twenty-eight participants had been exposed to English before the age of 5, and 22 had been exposed between ages 5 and 12. All participants were living in a bilingual community (Miami, FL) and using both languages in everyday life activities. Some of the participants were second-generation Latin American immigrants born in the United States, but other participants were born abroad and had arrived in the United States before the age of 12. All the participants' parents were native Spanish speakers born in Spanish-speaking countries, and Spanish was always the language spoken at home during childhood. All participants were nonpaid volunteers.

Results of the Spanish Syntactic Comprehension Test (Marcos & Ostrosky, 1995) were compared to the normative results obtained from the Spanish monolingual participant sample ($N = 40$) from Mexico City with a similar educational, age, and sex distribution. Normative results of this Mexican sample have been presented elsewhere (Marcos & Ostrosky, 1995). In Miami, it is virtually impossible to find a normal Spanish monolingual population sample with similar education, age, and sex characteristics. All native Spanish speakers in Miami, except a few elderly people and some very recently arrived immigrants, are bilingual to some degree. This was the only reason for using the normative results obtained from Mexico City.

Instrument. The Spanish Syntactic Comprehension Test developed by Marcos and Ostrosky (1995) was used. This is a normalized instrument used to assess the syntactic comprehension of Spanish. A forced election task is used in which the participant listens to 190 different reversible sentences and is asked to select, by pointing, one of four options presented on a plate. Each option contains a pair of animals performing a specific action, and only one option is correct. The four options correspond to (a) correct action and correct animal, (b) same action but performed by the wrong animal, (c) same animals but performing a different action, and (d) different pair of animals and the same action. Four pairs of animals (lion–tiger, camel–horse, duck–rooster, rabbit–skunk) and five different transitive Vs (*hit, kick, bite, pull,* and *pick*) are used based on pragmatic knowledge that both animals are equally able to perform the action. The position of the matching picture is randomized within sentence-distracter types. In the Spanish Syntactic Comprehension Test, the effects of different factors are studied: sentence type, presence and absence of the preposition, and the use of the definite or indefinite article.

The Spanish Syntactic Comprehension Test has the following characteristics:

1. Ninety active, 65 passive, and 35 pseudocleft reversible sentences are included, with a total of 190 sentences.
2. According to the position of the nominal phrases representing the A and the O of the transitive V, there are three different orders in the corpus for the active, six for the passive, and four for the pseudocleft sentences.
3. All the orders of constituents allowed in Spanish for each type of sentence are used, not including agrammatical sentences.
4. In half of the sentences, the first N is the A, and in the other half, the second N is the A.
5. The function of the preposition *a* (*to*) is analyzed. Active sentences with and without a preposition are included.
6. The definite and indefinite articles are distributed in the same proportion in all the sentences.

Thirty-eight different types of sentences and five examples of each type of sentence are included in the test. Examples are presented in Table 1.

Procedure. Before participants started the test, the ability to name the animals and actions was determined by means of picture identification. The participant was then told that a pair of animals would be included in each sentence, one of which would perform an action and the other that would be affected by it. The participant was further instructed to point at the picture corresponding to the sentences read by the examiner. A set of 20 different plates, each one containing four pictures, was used during sentence presentation. Sentences were read with a normal intonational contour by the examiner. Participants were not limited in their time to respond. Each sentence was repeated once to the participant on request. No feedback with regard to the accuracy of the answer was provided. The 190 randomized sentences (38 different types of sentences, each one appearing five times but using different Ns and Vs) were presented in a single session lasting about 30 to 40 min. A native Spanish-speaking graduate psychology student performed the testing.

Results

Table 1 compares the number of correct responses between the normative sample and the Spanish–English bilingual group. We observed that, in general, the performance on the Spanish Syntactic Comprehension Test was higher in the monolingual sample than in the bilingual sample. Differences were most evident in sentences with a pseudocleft A, followed by active reversible sentences without a preposition. Differences in passive sentences were virtually nonexistent. The order of difficulty in the bilingual sample was passive sentences (easiest), active reversible sentences with preposition, active reversible sentences without preposition, and sentences with a pseudocleft A (hardest).

Differences in the understanding of the following five types of sentences were statistically significant:

Table 1. *General Results: Percentage of Correct Responses*

Order	Article	Preposition	Example	Monolinguals[a]	Bilinguals[b]	χ^2	*p*
I. Active Reversible Sentences Without Preposition							
1. A–V–O	D/I	No	*El león golpeó un tigre.*	100.0	98.0	0.10	*ns*
2. O–V–A	I/D	No	*Un tigre golpeó el león.*	66.5	17.2	92.07	.001
3. A–O–V	D/I	No	*El león un tigre golpeó.*	94.5	65.2	23.10	*ns*
4. O–A–V	I/D	No	*Un tigre el león golpeó.*	83.5	75.6	5.25	*ns*
5. V–A–O	D/I	No	*Golpeó el león un tigre.*	94.5	74.0	11.40	*ns*
6. V–O–A	I/D	No	*Golpeó un tigre el león.*	65.5	55.6	3.53	*ns*
II. Active Reversible Sentences With Preposition							
7. A–V–O	D/I	Yes	*El león golpeó a un tigre.*	100.0	99.6	0.00	*ns*
8. A–V–O	D/I	Yes	*Un león golpeó al tigre.*	98.5	98.8	0.00	*ns*
9. A–O–V	D/I	Yes	*El león a un tigre golpeó.*	100.0	87.2	4.20	*ns*
10. A–O–V	I/D	Yes	*Un león al tigre golpeó.*	98.5	85.2	4.68	*ns*
11. V–A–O	D/I	Yes	*Golpeó el león a un tigre.*	98.5	92.8	0.91	*ns*
12. V–A–O	I/D	Yes	*Golpeó un león al tigre.*	98.5	91.6	1.31	*ns*
13. O–V–A	D/I	Yes	*Al tigre lo golpeó un león.*	100.0	98.8	0.03	*ns*
14. O–V–A	I/D	Yes	*A un tigre lo golpeó el león.*	100.0	96.0	0.40	*ns*
15. O–A–V	D/I	Yes	*A el tigre un león lo golpeó.*	97.5	95.6	0.06	*ns*
16. O–A–V	I/D	Yes	*A un tigre el león lo golpeó.*	100.0	92.4	1.44	*ns*
17. V–O–A	D/I	Yes	*Golpeó al tigre un león.*	96.0	86.0	2.60	*ns*
18. V–O–A	I/D	Yes	*Golpeó a un tigre el león.*	97.5	83.6	4.75	*ns*
III. Passive Reversible Sentences							
19. O–V–A	D/I	Yes	*El tigre fue golpeado por un león.*	100.0	99.6	0.02	*ns*
20. O–V–A	I/D	Yes	*Un tigre fue golpeado por el león.*	98.5	96.0	0.19	*ns*
21. A–V–O	D/I	Yes	*Por el león fue golpeado un tigre.*	96.0	91.2	0.60	*ns*
22. A–V–O	I/D	Yes	*Por un león fue golpeado el tigre.*	86.5	92.8	1.03	*ns*
23. O–A–V	D/I	Yes	*El tigre por un león fue golpeado.*	98.5	95.6	0.25	*ns*
24. O–A–V	I/D	Yes	*Un tigre por el león fue golpeado.*	98.5	96.8	0.10	*ns*
25. V–O–A	D/I	Yes	*Fue golpeado el tigre por un león.*	97.0	96.4	0.01	*ns*
26. V–O–A	I/D	Yes	*Fue golpeado un tigre por el león.*	100.0	94.8	0.67	*ns*
27. V–O–A	D/I	Yes	*Fue golpeado el tigre por un león.*	93.5	83.2	2.68	*ns*
28. V–A–O	I/D	Yes	*Fue golpeado por un león el tigre.*	98.5	89.2	2.33	*ns*
29. A–O–V	I/D	Yes	*Por el león un tigre fue golpeado.*	94.5	96.4	0.06	*ns*
30. A–O–V	D/I	Yes	*Por el león un tigre fue golpeado.*	98.5	96.8	0.10	*ns*
IV. Pseudocleft Agent With Preposition							
31. V–A–V–O	D/I	Yes	*Fue el león lo que golpeó a un tigre.*	98.5	90.4	1.78	*ns*
32. V–A–V–O	I/D	Yes	*Fue un león lo que golpeó al tigre.*	100.0	95.6	0.48	*ns*
33. V–O–V–A	D/I	Yes	*Lo que golpeó al tigre fue un león.*	97.0	94.0	0.26	*ns*
34. V–O–V–A	I/D	Yes	*Lo que golpeó a un tigre fue el león.*	98.5	88.8	2.53	*ns*
35. V–A–O–V	D/I	Yes	*Fue el león lo que a un tigre golpeó.*	93.5	34.8	91.48	.001
36. V–O–A–V	I/D	Yes	*Fue a un tigre lo que el león golpeó.*	97.0	46.0	67.42	.001
37. O–V–V–A	D/I	Yes	*Lo que al tigre golpeó fue un león.*	98.5	34.4	104.94	.001
38. O–V–V–A	I/D	Yes	*Lo que a un tigre golpeó fue el león.*	98.5	31.6	114.26	.001

Note: All sentences mean "The lion hit the tiger." A = agent; V = verb; O = object; D = definite; I = indefinite.
[a]$n = 40$. [b]$n = 50$.

1. Active reversible sentences without a preposition (O–V–A; e.g., "*Un tigre golpeó el león*" ["A tiger hit the lion"]).
2. Pseudocleft A with a preposition (V–A–patient–V; e.g., "*Fue el tigre lo que a un león golpeó*" ["It was the tiger that a lion hit"]).
3. Pseudocleft A with a preposition (V–patient–A–V; e.g., "*Fue a un tigre lo que el león golpeó*" ["It was a tiger that the lion hit"]).
4. Pseudocleft A with a preposition (patient–V–V–A; e.g., "*Lo que al tigre golpeó fue un león*" ["What the tiger hit was a lion"]).
5. Pseudocleft A with a preposition (patient–V–V–A; e.g., "*Lo que a un tigre golpeó fue el león*" ["What {to} the tiger hit was the lion"]).

Three variables were further analyzed: age when exposed to the L2, preferred language, and sex. Only the five sentences understood significantly differently between monolinguals and bilinguals were included in this analysis. Table 2 compares the effect of age when exposed to the L2. We observed that those participants exposed to the L2 (English) between ages 5 and 12 performed better than those individuals who were exposed before 5 years of age. Differences were statistically significant for all sentences with pseudocleft A and a preposition.

Table 3 compares the effect of the preferred language variable. Participants preferring Spanish outperformed those participants preferring English. In two sentences (pseudocleft A with preposition with the order V–A–O–V, and pseudocleft A with a preposition with the order O–V–V–A), the differences were statistically significant.

Table 4 compares the effect of the sex variable. We noted that the number of correct responses was about twice as high in women than in men. Except for the first sentences (active reversible sentences without preposition), these differences were statistically significant.

Study 2

Method

Participants. Participants were 69 middle socioeconomic status Spanish–English bilinguals. They were nonpaid volunteer graduate students recruited at an advanced studies institution in Miami, Florida. Their ages ranged from 18 to 49 (M = 30.28 years, SD = 7.97). There were 34 men and 35 women, of whom 27 were born in the United States and 42 were born in Latin America (Cuba =

Table 2. *Age Exposed to Second Language Effect: Percentage of Correct Responses*

Type of Sentence and Order	Article	Preposition	< 5[a]	5–12[b]	χ^2	*p*
I. Active Reversible Sentences Without Preposition						
2. O–V–A	I/D	No	11.4	24.5	0.84	*ns*
IV. Pseudocleft Agent With Preposition						
35. V–A–O–V	D/I	Yes	16.4	58.2	10.51	.01
36. V–O–A–V	I/D	Yes	22.8	75.4	12.71	.01
37. O–V–V–A	D/I	Yes	12.1	61.8	19.93	.01
38. O–V–V–A	I/D	Yes	13.5	54.5	13.13	.01

Note: O = object; V = verb; A = agent; I = indefinite; D = definite.
[a]n = 22. [b]n = 28.

Table 3. *Preferred Language Effect: Percentage of Correct Responses*

Type of Sentence and Order	Article	Preposition	Spanish[a]	English[b]	χ^2	*p*
I. Active Reversible Sentences Without Preposition						
2. O–V–A	I/D	No	23.3	13.7	3.68	*ns*
IV. Pseudocleft Agent With Preposition						
35. V–A–O–V	D/I	Yes	46.6	28.1	6.06	.05
36. V–O–A–V	I/D	Yes	55.5	40.6	3.06	*ns*
37. O–V–V–A	D/I	Yes	44.4	28.7	4.08	.05
38. O–V–V–A	I/D	Yes	38.8	27.5	2.71	*ns*

Note: O = object; V = verb; A = agent; I = indefinite; D = definite.
[a]n = 18. [b]n = 32.

Table 4. *Sex Effect: Percentage of Correct Responses*

Type of Sentence and Order	Article	Preposition	Men[a]	Women[b]	χ^2	*p*
I. Active Reversible Sentences Without Preposition						
2. O–V–A	I/D	No	12.2	20.0	1.63	*ns*
IV. Pseudocleft Agent With Preposition						
35. V–A–O–V	D/I	Yes	16.6	43.7	11.75	.01
36. V–O–A–V	I/D	Yes	27.7	56.2	9.70	.01
37. O–V–V–A	D/I	Yes	20.0	42.5	8.52	.01
38. O–V–V–A	I/D	Yes	17.7	39.3	7.96	.01

Note: O = object; V = verb; A = agent; I = indefinite; D = definite.
[a]$n = 18$. [b]$n = 32$.

19; Puerto Rico = 6; Colombia = 6; Venezuela = 3; Chile = 3; Panama, Ecuador, Dominican Republic, Peru, and Argentina = 1 in each country). In everyday life, they used English, Spanish, and "Spanglish" (i.e., mixture of Spanish and English with frequent code switching, and also Spanish spoken including a significant amount of English borrowings) for communicating. All participants claimed fluency in both languages, although the ability to write and read Spanish was limited in most participants born in the United States or arriving early in life. On a self-evaluation scale ranging from 1 (*virtually nothing*) to 5 (*excellent*), they rated themselves on spoken Spanish and English at the level 3 (*well*) or above. All the participants had Spanish as their L1 but had used English for more than 3 years. Some participants had been exposed to both languages since birth, and both languages could be considered as their L1. Twenty-seven participants stated that they preferred Spanish and spoke better Spanish than English (9 had learned English before age 12, and 18 had learned after age 12); 39 participants stated that they preferred English and spoke better English than Spanish (38 had learned English before age 12, and 1 had learned after age 12). Three pointed out that they could speak either language at the same level, and they did not have any significant difference in preference. These 3 participants were deleted from the sample in some analyses.

The age of acquisition of English ranged from 0 (Spanish and English were simultaneously learned) to 35 years ($M = 10.5$ years, $SD = 8.88$). As a result of living in a bilingual social environment (Miami, FL), borrowed words from English were frequently observed when participants spoke Spanish.[1]

[1]Rules governing borrowing are not well defined yet. Why is a particular word (and not another) borrowed? Everyday observation makes it apparent that in the majority of cases, the borrowed word is a N, and only sporadically an adjective or V. Grammatical connectors are not borrowed. One may hypothesize that there are several simultaneously acting principles:

Materials and procedure. A demographic questionnaire that we designed was administered to evaluate

1. In Spanish, there is not an exact word corresponding to the borrowed word (e.g., *driveway*).

2. The borrowed word presents some cultural salience in the new U.S. cultural context but not in the native one (e.g., *suit* as an appeal or legal demand).

3. The borrowed word has a very exact referent, or it is a sort of proper name (e.g., *income tax*)

4. In Spanish, there are several potentially correct words, but no one has the exact meaning (e.g., the word *ratio* corresponds in Spanish to *razón* or *relación*, but for both, the meaning corresponding to *ratio* is the secondary meaning, not the primary one), or there are significant regional variations with regard to that particular word. That is, although several words exist, no one word seems to be the superordinate word (e.g., *tag* is *placa, chapa,* or *tablilla; balloon* is *bomba* or *globo; carpet* corresponds in Spanish to both *tapete* and *alfombra*). In different Spanish-speaking areas, one of the two is preferred. Some mild variations with regard to the exact meaning can exist. So, *tapete* may denote it is smaller, *alfombra* may imply it is woven, and so on. To avoid having to make a selection from several alternatives, the superordinate English word is preferred.

5. From the phonological point of view, the borrowed word is accessible with the Spanish phonology (i.e., it is quite unlikely that a word with an extremely difficult phonology for Spanish speakers, such as *girl*, will be borrowed).

6. When the English word is phonologically simpler than the corresponding Spanish word, the English word can be borrowed (e.g., the English word *pin* is a notoriously simpler word than the Spanish word *alfiler*).

7. Very high frequency words and, in consequence, overlearned words are not usually borrowed from the L2 (e.g., words such as *casa* [*house*] and *mano* [*hand*] are never borrowed).

8. Use of technical words usually are also borrowed in other languages, becoming international words (e.g., *software*).

9. When a word is frequently used in everyday life in English, there is a tendency to continue using it when speaking native Spanish language (e.g., *mailbox*).

10. Finally, when the word has been learned in English, the meaning is more directly accessed in English than in Spanish. This may be particularly true with some professional and academic words (e.g., *standard deviation*). The very same principles may be assumed to apply in other similar linguistic contexts.

the characteristics of participants' bilingualism. Five subtests taken from the Wechsler Memory Scale (WMS) English version (Wechsler, 1945, 1987) and its equivalent translations to the Spanish language were used to compose an instrument that could evaluate memory in both languages. In addition, the Serial Verbal Learning Test (SVL; Ardila, Rosselli, & Puente, 1994) was administered in both languages. The resulting verbal memory section consisted of eight verbal memory subtests administered in the following order and language:

1. WMS Logical Memory (Spanish).
2. SVL (English).
3. Digits Forward–Backward (Spanish).
4. WMS Associate Learning (English).
5. SVL (Spanish).
6. WMS Logical Memory (English).
7. WMS Associate Learning (Spanish).
8. Digits Forward–Backward (English).

Instructions were presented in the corresponding language (Spanish or English), and participants were requested to use only Spanish or English according to the specific subtest.

To assess the participant's calculation ability in Spanish and English, three basic arithmetical operations and one numerical problem were performed aloud in both languages. This section was presented in the following order and languages:

1. Successive subtraction from 100 (to subtract 7 in a successive way from 100; Spanish).
2. One multiplication (12 × 23; Spanish).
3. One division (140 ÷ 15; Spanish).
4. Successive subtractions from 100 (to subtract 9 in a successive way from 100; English).
5. One multiplication (13 × 26; English).
6. One division (170 ÷ 13; English).
7. One numerical problem ("*Si tengo 18 libros distribuidos en dos paquetes, y en uno de los paquetes hay el doble de libros que en el otro, ¿cuántos libros hay en cada paquete?*" ["If I have 18 books distributed into two groups, and in one of the groups there are twice as many books as in the other, how many books are there in each group?"]; Spanish).
8. One numerical problem ("The sum of the ages of a father and a son is 48. If the father is triple the age of the son, how old are each one of them?"; English).

Time and errors were scored. However, errors were so low that no statistical analysis of errors was possible. Results, in consequence, refer only to time (sec).

After participants performed the calculation tasks, we assessed delayed recall with the following tests:

1. Delayed Associative Learning (Spanish).
2. Delayed Logical Memory (English).
3. Delayed SVL (Spanish).
4. Delayed Associative Learning (English).
5. Delayed Logical Memory (Spanish).
6. Delayed SVL (English).

WMS administration and scoring followed the guidelines provided by the WMS manual (Wechsler, 1945, 1987). In the SVL Test, three different scores were used: (a) number of words recalled in the first trial, (b) number of trials required to recall the 10-word list, and (c) delayed recall of the words. For the calculation portion, time was recorded for each subtest. Testing (including the demographic and history of bilingualism sections) lasted approximately 45 min. Performance in Spanish and English was compared using *t* tests. The age of acquisition effect and preferred language effect were analyzed using 2 × 2 factorial analyses of variance.

Results

Table 5 summarizes the results on the verbal and arithmetical tests used in this study. In general, performance was better in Spanish than in English. In the verbal memory subtests, out of 10 memory subtest scores, 4 (Delayed Logical Memory, Digits Forward, Total Digits, and Total Words) reached a statistical level of significance. Performance in English was better in Delayed Logical Memory and the 2 Digits scores. Performance was higher in Spanish in the Total Words of the SVL. On the calculation abilities test, performance was significantly faster in Spanish in 3 out of the 4 scores.

The effects of age of acquisition of the L2 was analyzed (Table 6). A language effect favoring Spanish was observed in the WMS Delayed Logical Memory and WMS Delayed Associative Learning, SVL Delayed Recall, and SVL Total Words. An age effect was found only in the WMS Digits subtest. Few interactions were significant: WMS Logical Memory (both conditions) and SVL Total Words and number of trials. A language effect was observed in three out of the four calculation abilities scores. Age effect was found in the

Table 5. *General Results in the Verbal Memory and Calculation Tests*

Test	English	Spanish	*t*	*p*
Wechsler Memory Scale				
Logical Memory				
M	10.28	10.36	0.19	.847
SD	3.46	2.93		
Delayed Logical Memory				
M	8.53	6.91	3.94	.001
SD	3.22	3.21		
Associate Learning				
M	15.44	15.12	0.83	.409
SD	3.06	3.53		
Delayed Associate Learning				
M	5.03	5.73	0.52	.598
SD	1.53	1.35		
Digits Forward				
M	6.72	6.21	3.48	.001
SD	1.19	0.97		
Digits Backwards				
M	5.72	4.65	1.43	.157
SD	1.25	1.10		
Total Digits				
M	11.72	10.86	3.89	.001
SD	2.03	1.75		
Serial Verbal Learning				
First Trial				
M	5.60	5.42	0.83	.408
SD	1.58	1.63		
Total Words				
M	39.36	49.09	2.29	.025
SD	5.77	5.34		
Number of Trials				
M	4.15	3.98	1.05	.296
SD	1.02	1.16		
Calculation Abilities				
Successive Subtractions				
M	35.50	42.39	2.06	.043
SD	25.42	30.86		
Multiplication				
M	16.38	12.86	3.25	.002
SD	8.10	7.28		
Division				
M	40.61	22.29	5.76	.001
SD	25.11	22.21		
Numerical Problem				
M	51.89	37.82	3.53	.001
SD	30.53	28.44		

Note: $n = 69$.

multiplication, and interaction was significant in the multiplication and division.

The effect of the preferred language was analyzed (Table 7). A language effect was found in 6 of the 11 verbal memory scores, whereas the preference effect was evident only in the WMS Digits (all conditions). Only four interactions were significant: Logical Memory (both conditions), Total Digits, and SVL Total Words. In the calculation abilities subtests, a language effect was observed in all scores, whereas the preferred language affected the numerical problem. Two interactions were significant: multiplication and division tests.

Discussion

Errors in the Spanish Syntactic Comprehension Test refer to identification of who the A is and, in consequence, who the patient (O) is. Four alternative responses were available, but the overwhelming majority of the errors did not refer to the misinterpretation of the action or the names of the animals included in the figures. Because of this, although four answers were available, only two answers were likely: "The lion [tiger, camel, horse, duck, rooster, rabbit, or skunk] hits [kicks, bites, pulls, or picks] the tiger [lion, camel, horse, duck, rooster, rabbit or skunk]" or the inverse. The task for the participant was to identify the A and the O. Consequently, the chance level may be supposed to be 50%.

Passive sentences are more frequently used in English than in Spanish, so it is not surprising that performance in understanding Spanish passive sentences was virtually perfect in our bilingual sample. However, when Spanish syntax moved apart from English syntax, difficulties emerged. Active reversible sentences with prepositions were almost normally understood. Differences between monolingual and bilingual participants were slight and nonsignificant due to an appropriate understanding of the use of the preposition *a*. The critical point is not the word order per se but understanding the markers distinguishing the A and the O. When the active sentences did not include the preposition *a*, however, understanding difficulties became evident. In this type of sentence without a preposition, the definite article marks the A, whereas the undetermined article points to the patient. This is a type of strategy not observed in English.

Sentences with a pseudocleft A were extremely difficult for bilingual participants. Significant difficulties were observed in the last four sentences. These sentences included a segment with an N plus a V. When, in this segment, the N was the A (Sentence 36), performance was about 50% (chance level). When the N was the O, the sentences were more frequently understood in the opposite sense, that is, as if the N were the A. This type of sentence, with a pseudocleft A, is not usually found in English.

Table 6. *Effect of the Age of Acquisition of Second Language on Verbal Memory and Calculation Tests*

	Age of Acquisition									
	< 12[a]		> 12[b]		Language Effect		Age Effect		Interaction	
Test	**English**	**Spanish**	**English**	**Spanish**	***F***	***p***	***F***	***p***	***F***	***p***
Wechsler Memory Scale										
Logical Memory										
M	10.7	10.2	9.26	10.6	0.98	.325	0.62	.430	4.27	.042
SD	2.7	3.1	4.6	2.5						
Delayed Logical Memory										
M	8.8	6.5	7.7	7.6	7.84	.007	0.00	.984	6.12	.016
SD	2.8	3.2	3.9	3.1						
Associate Learning										
M	5.6	5.2	5.6	5.8	0.11	.740	0.63	.427	1.22	.272
SD	1.6	1.7	1.3	1.7						
Delayed Associate Learning										
M	4.9	6.9	4.8	6.9	28.31	.001	0.01	.916	0.00	.943
SD	2.6	1.9	2.4	2.7						
Digits Forward										
M	7.0	6.4	6.1	5.7	9.30	.003	12.38	.001	0.12	.723
SD	1.1	0.9	1.2	1.1						
Digits Backward										
M	5.2	4.8	4.5	4.4	2.78	.100	4.21	.040	1.19	.278
SD	1.2	1.1	1.1	1.0						
Total Digits										
M	12.2	11.2	10.7	10.1	10.18	.002	9.75	.003	0.99	.322
SD	1.9	1.7	1.9	1.8						
Serial Verbal Learning										
First Trial										
M	5.6	5.3	5.6	5.8	0.11	.740	0.63	.427	1.22	.272
SD	1.7	1.7	1.4	1.7						
Total Words										
M	39.4	39.7	39.1	44.2	12.14	.001	3.15	.080	9.97	.002
SD	5.5	5.1	6.4	4.6						
Number of Trials										
M	4.2	4.3	4.1	3.4	3.80	.054	4.13	.046	5.95	.017
SD	1.0	1.0	1.1	1.3						
Delayed Recall										
M	4.9	6.9	4.8	6.9	28.31	.001	0.01	.916	0.00	.941
SD	2.6	2.0	2.4	2.7						
Calculation Abilities										
Successive Subtractions										
M	32.8	41.1	40.9	45.2	2.84	.096	0.91	.342	0.26	.606
SD	25.5	19.1	24.9	35.1						
Multiplication										
M	14.3	12.6	21.1	13.4	17.32	.001	5.78	.019	7.00	.010
SD	7.9	6.1	7.8	9.9						
Division										
M	34.8	23.1	53.8	20.4	49.22	.001	2.39	.126	11.45	.001
SD	23.5	25.4	27.4	12.48						
Numerical Problem										
M	50.4	33.8	55.1	46.9	5.12	.027	1.24	.270	0.58	.447
SD	39.9	26.2	42.9	37.3						

Note: $N = 69$.
[a]$n = 48$. [b]$n = 21$.

Table 7. *Preferred Language Effect on Memory and Calculation Test Performance*

	Prefered Language									
	Spanish		English		Language Effect		Preference Effect		Interaction	
Test	English	Spanish	English	Spanish	*F*	*p*	*F*	*p*	*F*	*p*
Wechsler Memory Scale										
Logical Memory										
M	8.8	10.9	11.4	10.0	1.20	.276	1.62	.207	21.19	.001
SD	3.8	2.8	2.8	3.0						
Delayed Logical Memory										
M	7.2	7.7	9.6	6.4	13.98	.001	0.72	.398	25.62	.001
SD	3.4	3.0	2.7	3.3						
Associate Learning										
M	14.4	14.7	16.2	15.4	0.33	.563	2.92	.092	1.71	.195
SD	3.0	3.5	3.0	3.7						
Delayed Associate Learning										
M	4.8	5.6	5.1	5.8	26.8	.001	0.71	.401	0.12	.728
SD	1.5	1.6	1.5	1.2						
Digits Forward										
M	6.0	5.8	7.2	6.4	8.20	.006	16.56	.001	3.55	.064
SD	1.2	1.0	1.0	0.9						
Digits Backward										
M	4.3	4.4	5.5	4.8	2.87	.095	13.14	.001	5.79	.019
SD	1.0	1.0	1.1	1.2						
Total Digits										
M	10.3	10.3	12.6	11.3	10.15	.002	19.78	.001	9.10	.004
SD	1.7	1.6	1.7	1.8						
Serial Verbal Learning										
First Trial										
M	5.4	5.8	5.7	5.2	0.06	.798	0.20	.653	4.71	.034
SD	1.5	1.5	1.6	1.9						
Total Words										
M	38.0	42.4	40.2	29.9	8.67	.005	0.01	.913	11.30	.001
SD	6.1	5.2	5.1	5.4						
Number of Trials										
M	4.4	3.9	4.1	4.1	1.39	.241	0.13	.714	2.66	.108
SD	1.0	1.2	1.0	1.1						
Delayed Recall										
M	4.5	6.9	5.2	7.1	31.31	.001	0.06	.418	0.39	.533
SD	2.4	2.5	2.7	2.0						
Calculation Abilities										
Successive Subtractions										
M	40.9	52.0	30.1	35.1	4.90	.030	5.61	.021	0.71	.040
SD	28.3	38.4	22.3	21.7						
Multiplication										
M	19.7	12.1	14.1	13.41	16.1	.001	1.94	.168	11.34	.001
SD	7.8	8.8	7.6	6.3						
Division										
M	50.9	22.7	33.1	22.7	37.3	.001	3.07	.089	7.90	.007
SD	31.0	16.6	20.0	26.1						
Numerical Problem										
M	58.3	47.3	44.0	32.6	7.63	.008	2.20	.142	0.02	.966
SD	40.5	42.3	32.8	25.1						

Note: $N = 66$.
[a]$n = 27$. [b]$n = 39$.

In brief, the closer to English syntax the Spanish sentences were, the easier it was for participants to understand them. The farther from English syntax the sentences were, the harder it became for the participants to interpret them correctly.

The significant effect of age exposed to the L2, preferred language, and sex variables deserve some comment. We found a very strong effect of age exposed to the L2. Participants exposed to English between ages 5 and 12 outperformed the participants exposed to English before the age of 5. This means that the interfering effect of English was stronger in the participants exposed to English before age 5. The preferred language effect is quite understandable. Participants preferring Spanish (or either) had a better syntactic understanding than those participants preferring English. *Preference* means that the participant feels more comfortable speaking that language. Preference, however, not only may relate to knowledge of the language but can also include affective relation with the language. Both are correlated.

The sex effect on language has been frequently reported (Kimura, 1992; MacCoby & Jacklin, 1974). The sex effect has been pointed out with regard to language acquisition (McGuiness, 1976; Smolak, 1986), spontaneous language during aging (Ardila & Rosselli, 1996), verbal fluency (Kolb & Whishaw, 1996), and other verbal abilities. This sex effect on linguistic abilities, however, remains controversial (Halpern, 1992; Hyde & Linn, 1988). Our results were not completely unexpected: Women outperformed men. To the best of our knowledge, however, sex differences with regard to syntactic comprehension had not been mentioned in the available literature.

In our second study, several significant differences were found in verbal memory and calculation subtests performed in Spanish and English. However, it must be emphasized that our sample was quite heterogeneous from a linguistic point of view, although spoken and written mastery of both languages was notoriously variable. This heterogeneity may have obscured the results.

Some significant differences in memory and calculation abilities were nevertheless found in Spanish–English bilinguals when tested in Spanish and English. Performance was overall better in the participant's L1 (Spanish) than in their L2 (English). Our results support Harris et al.'s (1995) findings. It is important to note that our bilingual participants were proficient in both languages and over half of them reported a better knowledge of English than of Spanish. In fact, a significant percentage of these participants could be considered balanced bilinguals. This similar level of proficiency as found in the majority of the participants may represent an additional factor responsible for the relatively modest differences found between both languages.

Although Spanish can be considered the L1 for this group, a significant percentage of the participants learned Spanish early in life, later attended school in English, and were currently living in a mostly English-speaking environment. They frequently reported English to be their best spoken and preferred language. Hence, although they were native Spanish speakers, they had a better knowledge of English. Preferred spoken language turned out to be a more significant variable than age of acquisition of the L2. Preferred language was significantly associated with the school language. Preferred language, however, was not a significant variable in the calculation subtests.

Age of acquisition turned out to be a significant variable only with regards to the WMS Digits and SVL number of trials. These results should be interpreted as a difference in the speed with which participants learned tasks presented in their L1 or L2. Although verbal learning is possible using either language, the speed of learning may be faster in one language.

Overall, differences in the calculation subtests were larger than differences in verbal memory tasks. An explanation could be that the language used in calculation tasks is the "thinking language," which is minimally influenced by social linguistic context, and that bilinguals continue using their native language in counting and other numerical issues. Consequently, better performance in Spanish was not unexpected.

Digit span was larger in English than in Spanish. It has been found that English speakers accomplish a digit span close to 7 digits, whereas digit span scores in Spanish speakers are usually about 5.8 (Ardila et al., 1994). Phonological length (number of phonemes) in Spanish and English digits represents a significant factor partially accounting for this difference (Olazaran, Jacobs, & Stern, 1996). The average number of phonemes in English digits is about three, whereas in Spanish it is about four (33% higher). Interestingly, digit span in Chinese (two phonemes per digit) is about 9 to 10 (Dehaene, 1997). Additionally, the 7-digit span is coincidental with the amount of digits in phone numbers, a highly overtrained everyday activity in English speakers in the United States. English speakers are in the habit of repeating phone numbers digit by digit (5–5–1–7–9–7–5), perhaps associated with the tendency to spell words, whereas Spanish speakers cluster telephone numbers by 2 and

even 3 digits (551–79–75) and do not routinely practice repeating 7-digit series. It is probable that, if a series of 2-digit numbers (i.e., 34–87–56, etc.) were used instead of single-digit-span numbers (i.e., 5–7–3, etc.), Spanish speakers would do as well or maybe even outperform English speakers. It is noteworthy that immediate verbal memory, measured according to the number of words repeated after single presentation (SVL, first trial score), was virtually identical in Spanish and English.

In the numerical section of the test, the differences between solving numerical problems in Spanish and English should be emphasized. When a numerical problem is being solved, not only is the application of an arithmetical procedure required but the correct understanding of the problem conditions is also necessary. A numerical problem represents a reasoning task. This significant difference between both languages on this task suggests a better ability for reasoning when using a native language or L1 than when an L2 is used. It should be emphasized, however, that we were exploring the ability to reason with a particular language, not reasoning per se. It is noteworthy that, in our experimental conditions, it took longer to say the Spanish problem (51 syllables) than the English one (36 syllables).

These results have an extremely important consequence for the neuropsychological testing of Hispanics in the United States: Spanish–English bilinguals may be at a disadvantage when using either language. For bilingual participants, both languages were active languages, and their functional language was not either Spanish or English but a mixture of both. Interference is expected to be high. To use either Spanish or English testing materials and norms can penalize U.S. Spanish–English bilinguals. No clear solution to this difficulty is available.

Three procedures, however, could at least reduce the bilingualism effect in psychological and neuropsychological testing:

1. Special norms should be established for Spanish–English bilinguals. This solution does not seem easy when the tremendous heterogeneity of U.S. bilingualism is taken into consideration.

2. The examiner could be a bilingual mastering a similar type of biligualism. Testing could be performed in Spanish, English, or both languages. Instructions and answers in either language or both languages could be acceptable; both English and Spanish norms could be used, with the one favoring the participant being preferred. Nonetheless, the examiner should also be trained in the scientific and clinical understanding of bilingualism.

3. The scores should be adjusted to neutralize the penalizing effect of bilingualism. The problem is that we do not know how much the test scores should be adjusted to be fair at best. Of course, it depends on the test, the idiosyncrasies of the client's bilingualism, and the testing situation, including the examiner's language.

None of these three solutions alone or combined seem easy to put in action. However, when U.S. Hispanic bilinguals are tested, it should be emphasized that the results do not necessarily reflect the participant's real abilities, and his or her real performance may be higher than observed. Clearly, in any bilingual neuropsychological report, the participant's degree of bilingualism (at least age of acquisition of the L2, schooling language, and use of both languages in everyday life), language used in testing, norms used, and caution regarding the potentially penalizing effect of bilingualism should be mentioned.

It should be noted that the penalizing bilingualism effect is expected in neuropsychological testing when verbal materials are included. Bilinguals, however, are not expected to be at a disadvantage in other circumstances, for example, when attending rehabilitation programs. In such a cases, bilingualism may even present some advantage.

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