Verbal intelligence in bilinguals when measured in L1 and L2

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Verbal intelligence in bilinguals when measured in L1 and L2

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ABSTRACT
This study was aimed at studying the Verbal IQ in two groups of Spanish/English bilinguals: simultaneous and early sequential bilinguals. 48 Spanish/English bilinguals born in the U.S. or Latin American countries but moving to United States before the age of 10 were selected. The verbal subtests of the Wechsler Adult Intelligence Scale (English and Spanish) – Third Edition (WAIS-III) was administered. Overall, performance was significantly better in English for both groups of bilinguals. Verbal IQ difference when tested in Spanish and English was about one standard deviation higher in English for simultaneous bilinguals, and about half standard deviation for early sequential bilinguals. In both groups, Verbal IQ in English was about 100; considering the level of education of our sample (bachelor degree, on average), it can be assumed that Verbal IQ in English was lower than expected, suggesting that bilinguals may be penalized even when evaluated in the dominant language.

KEYWORDS
Cognition; Spanish/English bilingualism; verbal intelligence; vocabulary; Wechsler Adult Intelligence Scale

Introduction
Controversy has surrounded the topic of cognition measurement in a person’s native language (L1) and the second language (L2) (Mindt et al., 2008; Pham, Castro-Olivo, Chun, & Goforth, 2017). Some authors have proposed that introducing children to multiple languages at a young age will cause confusion or delays in development, and consequently in verbal intelligence (Petitto & Holowka, 2002). However, diverse recent studies have suggested that bilinguals usually have a better cognitive control, including verbal control, than monolinguals (Friesen, Luo, Luk, & Bialystok, 2015; Woumans, Ceuleers, Van der Linden, Szmalec, & Duyck, 2015).

Dual language learning is influenced by many factors, including, input, language access, access to literacy, family language use, and community support (Pearson, 2007). Consequently, diverse types of bilingualism can be distinguished. An individual who acquires two languages since the first year of life can be considered a “simultaneous bilingual” (Paradis, Crago, & Genesee, 2011). An individual exposed to another language after three years of life is considered a “second language learner” (Paradis et al., 2011); this individual can be considered as a “sequential bilingual.” If the second language is acquired before adolescence, the individual will be regarded as an “early sequential bilingual”; if the second language is learned after adolescence, we refer to a “late sequential bilingual.”

Diverse bilingualism advantages have been suggested during recent years, particularly with regard to executive functioning (e.g., Calvo & Bialystok, 2014; Kroll & Bialystok, 2013; Olsen et al., 2015; Sorge, Toplak, & Bialystok, 2017). Marian, Faroqi-Shah, Kaushanskaya, Blumenfeld, and Sheng (2009) observed superior divergent thinking ability and meta-cognitive skills in bilingual children compared to monolingual peers. Bilingual children in middle school score at an equal level on verbal skills as their monolingual counterparts. Thus far, there has been no evidence indicating that bilingual individuals have lower intellectual verbal abilities than monolinguals. The issue with assessment is that, oftentimes, these individuals are assessed in only one language, leading to an inaccurate result. Consequently, results are not representative of the whole verbal individual’s abilities (Marian et al., 2009).

There is a crucial question in testing bilingual individuals; does the language used in testing result in different scores in bilinguals (Pham et al., 2017)? There is not a clear answer to this question, because of the heterogeneity of bilingualism; although, it is usually considered that the dominant language should be preferred when testing bilinguals (Cummins & Swain, 2014; Gathercole & Thomas, 2009).

Intelligence test batteries have been used to evaluate cognitive abilities, so verbal and nonverbal. The usage of verbal tests among individuals who are not proficient enough in the language the test is administered,
however, has been criticized (Naglieri & Bornstein, 2003; Pham et al., 2017; Suzuki & Valencia, 1997). A
significant disadvantage for individuals with low language proficiency is evident. It is not unexpected that bilingual individuals when tested in L2 usually perform significantly worse than monolingual control individuals (Garratt & Kelly, 2007; Karlsson et al., 2015).

However, when nonlanguage tests are used (Jarvis, Danks, & Merriman, 1995; Naglieri, Otero, DeLauder, & Matto (2007) or when the bilingual individual has had the opportunity to acquire a high proficiency in his/her second language no differences with monolinguals are expected (e.g., Karlsson et al., 2015). Rosselli et al. (2000) reported a similar performance between Spanish/English bilinguals and English monolinguals on diverse tests excepting semantic verbal fluency tasks. They also observed that bilinguals who learned English before age 12 performed significantly better on the English repetition test and produced a higher number of words in the description of a picture than the bilinguals who learned English after age 12. In the same vein, Kalia, Wilbourn, and Ghio (2014) found that early bilinguals perform similar to monolinguals and higher than participants those who are exposed to a second language later in life.

Available information about verbal intelligence in bilinguals when tested in L1 and L2 is not readily available and that information is crucial to quantify the discrepancy in verbal intelligence between L1 and L2. The purpose of the current research was to find out the bilinguals Verbal IQ when tested in L1 and L2. Given the significant heterogeneity of bilingualism two specific and relatively homogenous types of bilingualism were analyzed. A sample of simultaneous (exposed to both languages before the age of one year) and early sequential (learning the second language before the age of 10) Spanish/English bilinguals was selected in Miami. It was hypothesized that higher IQ scores would be found in English, because this was the language most frequently used at school. It was also anticipated that those participants living during several years in monolingual Spanish-speaking countries would obtain better IQ scores in Spanish than those individuals born and raised in a bilingual environment.

**Method**

**Participants**

Forty-eight Spanish/English simultaneous and sequential bilinguals fulfilling the following characteristics were selected: (a) 18–40 years old; (b) born in the United States to Spanish-speaking parents, or moved to Miami from a Latin American country before the age of 10; and (c) no documented neurological diagnosis (seizures, tumors, strokes, learning disabilities, etc.). Participants were Florida International University students, or family or friends of current Florida International University students.

Demographics were compiled for each participant which included: participants’ age, age of arrival to the United States (if applicable), age when second language was learned (if applicable), birthplace of parents, languages spoken by each parent, language spoken at home, language spoken to siblings (if applicable), level of highest education achieved, language in which instruction was received at each school level, percentages of each language used daily, and participants’ view of his/her own speaking and reading skill level in each language.

Twenty-seven of the participants were born in the United States (simultaneous bilinguals); 21 were born in different Latin American countries (Cuba = 9; Venezuela = 3; Argentina = 2; Colombia = 2; Peru = 1; Dominican Republic = 1; Ecuador = 1; Nicaragua = 1; Puerto Rico = 1) but arrived in the United States before the age of 10 (early sequential bilinguals). For all these subjects, both parents were native Spanish speakers and the home language during childhood was Spanish. Table 1 presents a summary of the participants' demographic characteristics.

Thirty participants (63%) reported that currently Spanish was the only language used within the home environment. Fifteen (31%) of the participants used both English and Spanish within the household and 3 (6%) participants, mostly used English. 58.3% of participants spoke English in Primary/Elementary school, while 95.8% spoke English in middle school and 97.9% of participants reported speaking only English in high school.

<table>
<thead>
<tr>
<th>Age arrival</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>6.67 (2.35)</td>
</tr>
</tbody>
</table>

**Table 1.** Participants' demographic information.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Education</th>
<th>U.S. born (n = 27)</th>
<th>Latin Am (L.A.) born (n = 21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>High Sch</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Females</td>
<td>Associate</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Bachelor</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Doctorate</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: For age, and age of arrival to USA, means and standard deviations (in parentheses) are presented. Gender differences between U.S. born and L.A. are not statistically significant (chi-square = .038, p = 0.536). The education level differences between U.S. born and L.A. are not either statistically significant (chi-square = 1.57, p = 0.957).
The participants were requested to complete a self-assessment, which indicated the level of speaking and reading proficiency in both languages. In terms of spoken Spanish, 20.8% of the participants rated themselves as “excellent,” whereas 87.5% rated their spoken English as “excellent.” When considering their reading skills, 25% of the participants considered their skills in Spanish as “excellent,” whereas 81.3% considered their reading skills in English as “excellent.” In the daily life, they reported using English 68% of the time, and Spanish only 32%.

**Instruments**

The following instruments were individually administered:
- Bilingualism Questionnaire adapted from M. Paradis (1987): administered in English

**Procedure**

Testing was completed at the Department of Communication Sciences and Disorders of the Florida International University, on a one-on-one basis in various locations that suited the availability of the participants. First, the participants were required to sign a consent form. The consent form detailed the objectives of the study and the requirements to be considered a participant. Then Bilingualism Questionnaire was orally presented by asking the participant for basic demographic and linguistic information. At the end of the questionnaire, the participant was presented the questionnaire to rate their English and Spanish speaking and reading skills on a Likert-type scale of one (being almost none) to seven (being excellent).

Testing protocols were numbered in a consecutive way. Testing order (Spanish first, English second; or English first, Spanish second) was determined on the test subject number, which was assigned. Odd subject number (testing protocol 1, 3, 5, etc.) would result in testing in English first; even number (testing protocol 2, 4, 6, etc.) resulted in Spanish first. Testing took approximately 50–60 minutes to complete, per participant.

The two applications of the WAIS were done with an interval of about 30–40 minutes. During this interval, other verbal tests were administered. Although a memory effect could occur, this memory effect was mild, and results were similar when the order was taken into account.

The subtests used from the WAIS-III were: Vocabulary, Similarities, Arithmetic, Digit Span, Information, Comprehension, and Letters and Numbers; and were administered in this order. The last test is not including in calculating the verbal IQ. Letters and Numbers is indeed a working memory/executive functions test, used as control. All subtests were scored using the WAIS-III Examiner Manuals. Comparisons were made using both the scaled scores and the Verbal IQ.

**Statistical analysis**

Considering that dependent variable (test scores) had a normal distribution, a *t*-test was used to analyze the differences between Spanish and English. A *p* < 0.01 level of significance to analyze the data was used.

**Results**

Mean scores and standard deviation for each subtest were calculated in both English and Spanish.

Table 2 and Table 3 demonstrate the results obtained through administration of the WAIS-III in both English and Spanish. Table 2 presents U.S. born participants, while Table 3 presents Latin–American born participants.

As shown in Table 2, in the following subtests differences between English and Spanish scores were statistically significant in U.S. born participants: Vocabulary, Similarities, and Information. Verbal IQ was average in English (100.15) but about one standard deviation lower in Spanish (84.63). The subtest with the highest differences between both languages was Vocabulary; in this subtest the score in English was almost twice of the Spanish score.

**Table 2.** U.S. Born participants: Scaled scores in the different WAIS-III verbal tests.

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>SD</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocabulary</td>
<td>9.22</td>
<td>3.78</td>
<td>4.96</td>
<td>2.21</td>
<td>5.09</td>
<td>0.001</td>
</tr>
<tr>
<td>Similarities</td>
<td>10.93</td>
<td>2.88</td>
<td>8.30</td>
<td>2.70</td>
<td>3.46</td>
<td>0.001</td>
</tr>
<tr>
<td>Arithmetic</td>
<td>7.70</td>
<td>2.77</td>
<td>6.37</td>
<td>2.75</td>
<td>2.16</td>
<td>0.055</td>
</tr>
<tr>
<td>Digit Span</td>
<td>11.11</td>
<td>2.42</td>
<td>9.78</td>
<td>2.36</td>
<td>2.02</td>
<td>0.022</td>
</tr>
<tr>
<td>Information</td>
<td>8.85</td>
<td>3.11</td>
<td>6.63</td>
<td>2.83</td>
<td>2.74</td>
<td>0.004</td>
</tr>
<tr>
<td>Comprehension</td>
<td>8.59</td>
<td>2.62</td>
<td>7.59</td>
<td>3.13</td>
<td>1.27</td>
<td>0.104</td>
</tr>
<tr>
<td>Letters and Numbers</td>
<td>10.44</td>
<td>2.72</td>
<td>9.33</td>
<td>2.85</td>
<td>1.46</td>
<td>0.074</td>
</tr>
<tr>
<td>Total Scaled Scores</td>
<td>61.34</td>
<td>10.76</td>
<td>47.33</td>
<td>11.50</td>
<td>4.75</td>
<td>0.001</td>
</tr>
<tr>
<td>Verbal IQ</td>
<td>100.15</td>
<td>11.61</td>
<td>84.63</td>
<td>12.61</td>
<td>4.70</td>
<td>0.001</td>
</tr>
</tbody>
</table>

In Table 3, results for the Latin American born participants are presented. Only in the Vocabulary subtest differences between both languages (9.48 and 6.90) were statistically significant; scores in Spanish were about 30% lower than in English. Verbal IQ differences (101.52 and 94.76) represent about half a standard deviation and were significant at the 0.02 level.

The Letters and Numbers subtest is not used to calculate the verbal IQ. This is a subtest that can be regarded as working memory/executive functioning verbally mediated test. Differences between both languages were neglectable, and even in the Latin-American born group score was mildly higher in Spanish.

Discussion

Results from the WAIS-III are indicative of a significant difference in Verbal IQ when testing was administered in English (dominant language) and Spanish (primary language). Noteworthy, in our bilinguals, regardless that Spanish was the primary language (L1) English became the dominant language mainly as a result of schooling. It is usual that in bilinguals the school language becomes the dominant language (Ardila, 2016; Portes & Schauffler, 1994).

For both subgroups of bilinguals, highest differences between Spanish and English were observed in the Vocabulary subtest. Regardless that our participants had a relatively high level of education—bachelor degree in average—even in English the scaled score was below the expected mean (10), suggesting that vocabulary knowledge is decreased even when testing is performed in the dominant language. It may be conjectured that using a single language does not appropriately assess the whole bilingual’s linguistic resources.

Furthermore, the English Verbal IQ was about 100 for both groups of participants; that corresponds to the mean score for the normative sample, but is below the expected score for individuals with a — in average—college level of education. It is well known that there is a significant association between IQ and level of education (Ceci, 1990; Ceci & Williams, 1997; Kaufman, Reynolds, & McLean, 1989; Neisser et al., 1996), and people with a college level of education usually obtain IQ scores above the mean for the normative sample.

Total scaled scores and Verbal IQ in English were similar when comparing U.S. born participants and Latin-American born participants. They were clearly higher than the Spanish Verbal IQ scores. However, Total Scaled Scores and Verbal IQ in Spanish were higher—but anyhow below the expected mean—in Latin American born participants than in U.S. born participants. This result is congruent with the proposal of Gasquoine, Croyle, Cavazosgonzalez, and Sandoval (2007), which stated that the language of administration will produce higher scores in the dominant language of Spanish or English dominant bilinguals. This was also observed with the administration of the Woodcock Munoz Language Survey-Revised (WMLS-R) where the English dominant bilingual group mean was significantly higher in English than Spanish. Inversely, the Spanish dominant bilingual group mean was significantly higher in Spanish than English (Gasquoine et al., 2007).

The majority of participants in both groups scored higher on the WAIS-III verbal subtests when tested in English compared to when they were tested in Spanish. It is well-known that second-generation Latinos usually report higher fluency in English than Spanish. This may be due not only to the school language, but also to a decreasing use of Spanish in their everyday lives. In our participants, English was about twice more used on a daily basis than Spanish.

The question of how evaluate linguistic abilities in bilinguals remains controversial (De Lamo White & Jin, 2011; Grech & Dodd, 2011; Kayser, 1989). Our results suggest that using the dominant language does not correctly appreciate the total individual’s linguistic ability. A bilingual, particularly an active bilingual using both languages in the daily life, possess a language knowledge that includes elements from L1 and L2; s/he has a linguistic representation that is not limited to only one of the languages. Consequently, testing only one of the language will results in an inaccurate appreciation of his verbal ability. Using a bilingual testing strategy, that is, accepting answers in both languages, could potentially represent a more accurate and fair approach.

Our results have significant implications for the neuropsychological assessment of bilingual populations. Using the nondominant language may result in a score significantly lower than the score obtained when using.

Table 3. Latin America born participants: Scaled scores in the different WAIS-III verbal tests.

<table>
<thead>
<tr>
<th>Test</th>
<th>English</th>
<th>SD</th>
<th>Spanish</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocabulary</td>
<td>9.48</td>
<td>2.50</td>
<td>6.90</td>
<td>2.36</td>
<td>3.42</td>
<td>0.001</td>
</tr>
<tr>
<td>Similarities</td>
<td>10.67</td>
<td>2.13</td>
<td>9.71</td>
<td>2.24</td>
<td>1.41</td>
<td>0.082</td>
</tr>
<tr>
<td>Arithmetic</td>
<td>8.90</td>
<td>2.81</td>
<td>8.00</td>
<td>3.22</td>
<td>0.96</td>
<td>0.169</td>
</tr>
<tr>
<td>Digit Span</td>
<td>11.57</td>
<td>2.58</td>
<td>10.71</td>
<td>2.92</td>
<td>1.01</td>
<td>0.159</td>
</tr>
<tr>
<td>Information</td>
<td>8.71</td>
<td>2.78</td>
<td>7.71</td>
<td>2.69</td>
<td>1.18</td>
<td>0.121</td>
</tr>
<tr>
<td>Comprehension</td>
<td>8.90</td>
<td>2.21</td>
<td>9.14</td>
<td>1.65</td>
<td>0.39</td>
<td>0.347</td>
</tr>
<tr>
<td>Letters and Numbers</td>
<td>9.43</td>
<td>3.28</td>
<td>9.86</td>
<td>3.80</td>
<td>0.39</td>
<td>0.348</td>
</tr>
<tr>
<td>Total Scaled Scores</td>
<td>62.90</td>
<td>8.67</td>
<td>56.57</td>
<td>9.78</td>
<td>2.22</td>
<td>0.016</td>
</tr>
<tr>
<td>Verbal IQ</td>
<td>101.52</td>
<td>9.16</td>
<td>94.76</td>
<td>10.54</td>
<td>2.21</td>
<td>0.016</td>
</tr>
</tbody>
</table>

Note: WAIS-III = Wechsler Adult Intelligence Scale-Third Edition.
the dominant language. Nonetheless, even using the dominant language, scores in language tests may not reflect the patient’s whole linguistic ability. As clearly stated by Grosjean (1989), a bilingual is not two monolinguals in one person. The obvious conclusion is that bilinguals should be evaluated using a bilingual procedure. Unfortunately, this solution does not seem realistic.

Finally, some important limitations should be recognized. First, our sample was relatively small, and hence current results must be corroborated using larger samples of participants. Furthermore, we were studying two very specific types of bilingualism, in a specific linguistic community. Miami bilingualism has some evident idiosyncrasies (Ardila, 2016; Carter & Lynch, 2015; Eilers, Pearson, & Cobo-Lewis, 2006), limiting the generalization of our results. Bilingualism is a quite heterogeneous and complex phenomenon (Ardila, 2007). Another important limitation of the current study was the use of the WAIS-III. However, our study was directed to find out the potential difference in verbal intelligence when using the same instrument in Spanish and English. It can be conjectured that similar differences would be observed if using a different verbal intelligence test, for instance, the WAIS-IV. The major point is that scores are significantly different in Spanish and English. This is an issue that has to be taken into consideration in any cognitive testing in bilinguals.

**References**


