The Influence of English as a Second Language on Verbal Fluency Performance

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Overview of Study

- Background
- Hypotheses
- Methods
- Results
- Discussion
Bilingualism is extremely prevalent, with more than 50% of the world’s population being bilingual or multilingual (Grosjean, 2008; Taler et al., 2013).

In 2011, 21% of the US population spoke a language other than English at home (Ryan, 2013).

Recent studies found that bilinguals perform differently than monolinguals on tests of neuropsychological functioning (Bialystok, 2009; Gollan et al., 2002; Taler et al., 2013).
Neuropsychological Assessment

- Assesses brain and behavioral relationships to assist in diagnosis and treatment planning.

  Cognitive Domains Assessed:
  - Attention
  - Processing Speed
  - Language
  - Executive Functioning

- Many neuropsychological tests actually measure multiple cognitive domains
Verbal Fluency Tasks

- Frequently used to assess *both* language and executive function (Bialystok, 2009; Troyer, 2000).

- Generate as many words as possible in a time limit
  - Score = total words generated

- Other characteristics of performance:
  - Clustering
  - Switching
Two types of clustering:
1. Phonemic
   e.g. (category) letter “W” ➔ (subcategory) “wallet, walrus, wander”
2. Semantic
   e.g. (category) animals ➔ (subcategory: domesticated) “cat, dog, rabbit”

Two types of switching:
1. Phonemic
   e.g. “walrus, wander” ➔ “willing” and “willow”
2. Semantic
   e.g., “hamster, mouse” ➔ “fish, dolphin”
      (domesticated) ➔ (animals in ocean)
The Bilingual Experience

Language: Bilinguals < Monolinguals

- Bilinguals have lower levels of vocabulary than monolinguals (Bialystok, et al., 2009; Luo, et al., 2010).

Executive Function: Bilinguals > Monolinguals

- Bilinguals have two co-existing languages that are both active and competing, forcing them to inhibit one language (Crinion et al., 2006; Luo, Luk & Bialystok, 2009).
- The bilingual must constantly shift back and forth between languages (Bialystok, 2009; Pen et. al., 2010).
Verbal Fluency Tests and Bilingualism

- Bilinguals < Monolinguals on verbal fluency tasks for total words (Portocarrero et. al., 2007; Troyer, 2000).

- No differences in switching and clustering performances between monolinguals and bilinguals (Taler, 2013).

- Suggests that when assessing bilinguals, a closer look at performance strategies, not just total words, should be considered, to better understand the bilingual brain.
Goal: Further explore the performance discrepancies found between individuals for monolinguals and bilinguals on verbal fluency tasks.

- Total words
- Clustering and switching
Hypotheses

► Hypothesis 1: EFL will outperform ESL speakers on the verbal fluency task when only total words generated is scored, cross-validating previous findings.

► Hypothesis 2: ESL will more effectively use clustering and switching compared to EFL, to the extent these scores reflect executive functioning.
Participants: 139 neurologically and psychologically healthy undergraduate students were used for study:

1. Monolinguals: EFL (n=83)
2. Bilinguals: ESL (n=56)

Exclusion Criteria: participants who had history of the following ailments were excluded from the study:

1. Epilepsy
2. Loss of consciousness (TBI)
3. Stroke
4. Cancer
5. Multiple Sclerosis
6. HIV/AIDS
7. Psychiatric Disorders
8. Substance Abuse
Participants were administered two measures of verbal fluency:

- Controlled Oral Word Association Test (COWAT): Generate as many words as possible for a given letter within a minute. Three trials using three different letters (phonemic fluency).
- Category Naming: Generate as many words as possible for a particular category within a minute (semantic fluency).
Sample of Verbal Fluency Measure

T
- Together
- To
- Target
- Tangible
- Tassel
- Toe

O
- Open
- Organize
- Oral
- Oat
- Otter

P
- Play
- Plate
- Pilgrim
- Pill
- Picture

Vegetables
- Carrot
- Peas
- Squash
- Spinach
- Pickles
Table 1. Demographics of sample.

<table>
<thead>
<tr>
<th></th>
<th>EFL (n=80)</th>
<th>ESL (n=48)</th>
<th>t/x2</th>
<th>p</th>
<th>Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs; M, SD)</td>
<td>19.9 (2.5)</td>
<td>20.1 (3.0)</td>
<td>-.428</td>
<td>.669</td>
<td>None</td>
</tr>
<tr>
<td>Education (yrs; M, SD)</td>
<td>12.6 (1.1)</td>
<td>12.7 (1.3)</td>
<td>-.555</td>
<td>.580</td>
<td>None</td>
</tr>
<tr>
<td>Female (%)</td>
<td>70%</td>
<td>71%</td>
<td>.039</td>
<td>.844</td>
<td>None</td>
</tr>
</tbody>
</table>
Table 2. Neuropsychological Performance by Group

<table>
<thead>
<tr>
<th></th>
<th>EFL</th>
<th>ESL</th>
<th>t</th>
<th>P</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COWAT Total Words</strong></td>
<td>36.82 (8.88)</td>
<td>32.46 (9.82)</td>
<td>2.72</td>
<td>.007*</td>
<td>EFL&gt;ESL</td>
</tr>
<tr>
<td></td>
<td>n=83</td>
<td>n=56</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Phonemic Switches</strong></td>
<td>25.44 (7.21)</td>
<td>21.92 (5.81)</td>
<td>2.89</td>
<td>.005*</td>
<td>EFL&gt;ESL</td>
</tr>
<tr>
<td></td>
<td>n=79</td>
<td>n=49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Phonemic Clusters</strong></td>
<td>.37 (.18)</td>
<td>.36 (.15)</td>
<td>.36</td>
<td>.72</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n=79</td>
<td>n=49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Semantic Switches</strong></td>
<td>10.24 (3.28)</td>
<td>10.08 (2.71)</td>
<td>.27</td>
<td>.78</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n=80</td>
<td>n=48</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Semantic Clusters</strong></td>
<td>.88 (.42)</td>
<td>.86 (.43)</td>
<td>.26</td>
<td>.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n=80</td>
<td>n=48</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Notes: *p<.05; EFL = English as a first language; ESL= English as a second language; COWAT = Controlled Oral Word Association Test
Hypothesis 1: Supported
- Analysis revealed that there was a significant difference between groups for total words generated in the expected direction (EFL > ESL).

Hypothesis 2: Not Supported
- An unanticipated difference was found in phonemic switching (EFL > ESL).
- No differences between groups on clustering or semantic switching were found.
The results further support previous findings on the effects of bilingualism on verbal fluency scores with respect to total scores. Previous research: bilinguals < monolinguals for vocabulary (Bialystok, et al., 2009; Luo, et al., 2010)

However, it was unexpected that EFL>ESL on phonemic switching. Previous research found that the number of switches decreases in a dual-task condition (Raboutet et al., 2010). Bilinguals are constantly in a dual-task situation because they must deal with their competing languages.
This study contributes to the literature by helping to characterize the bilingual brain (Troyer, 2000).

- Help avoid misrepresentation of bilinguals’ performance
- Performance needs to be compared to the corresponding reference group.
Limitations of this study

Threats to external validity
- The use of a convenience sample size
- Decreased generalizability of our findings

Threats to internal validity
- Small sample size decreases power
- Disproportionate sample size between groups
- Subjective nature of scoring performance characteristics
- Retrospective self-reporting
Future research should continue to investigate the influence that language, culture, and other life experiences have on neuropsychological test performance (Romero et al., 2009; Teng & Manly, 2005).

- Designed for detection of brain injuries and disease, but are sensitive to other unanticipated variables.
- We need to understand what these influences are to help guide a more accurate interpretation of test results.
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