Development of Executive Functions in Monolingual and Bilingual Children: Separating Working Memory and Inhibitory Control

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Introduction

- Previous research has shown that constant management of two languages on a daily basis enhances executive control.
- For example, young bilingual children (4-9 years old) demonstrated more effective controlled processing than monolinguals on the flanker task and on the Simon task.
- We attempted to examine which aspects of executive functioning (cognitive control) develop precociously in bilingual children.

Background Measures

- Bilinguals showed better working memory than monolinguals on the forward digit span task, the frog spatial sequence task, and the arbitrary symbol task.
- Bilinguals showed better inhibitory control than monolinguals in the incongruent condition of the low working memory/transparent symbol task, where virtually no memory was required.
- Previous research has shown that constant management of two languages on a daily basis enhances executive control.
- For example, young bilingual children (4-9 years old) demonstrated more effective controlled processing than monolinguals on the flanker task and on the Simon task.

Task Design

- 48 Trials: 24 Congruent & 24 Incongruent

Conclusions

- Bilinguals showed better working memory than monolinguals on the forward digit span task, the frog spatial sequence task, and the arbitrary symbol task.
- Bilinguals showed better inhibitory control than monolinguals in the incongruent condition of the low working memory/transparent symbol task, where virtually no memory was required.
- Bilinguals were thus better at resolving conflict in that situation.

Sequencing Span Task

- Repeat a list of single digit number in ascending order, starting from 2 numbers in a list

Frog Matrix Spatial Span Task

- Recall the locations of presentations of a cartoon frog in a 3 X 3 matrix in order, starting from 2 presentations in a series.

Sequencing Span Task

<table>
<thead>
<tr>
<th>Groups</th>
<th>Age (years)</th>
<th>PPVT* (Receptive Vocabulary)</th>
<th>Sequencing Span Task (Working Memory)</th>
<th>Frog Matrix Spatial Span Task (Spatial Working Memory)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monolingual (n=23)</td>
<td>6.8 ± 0.6</td>
<td>102.3 ± 15.5</td>
<td>16.0 ± 9.2</td>
<td>44.7 ± 16.2</td>
</tr>
<tr>
<td>Bilingual (n=23)</td>
<td>7.1 ± 0.7</td>
<td>96.2 ± 8.2</td>
<td>21.7 ± 7.3</td>
<td>53.1 ± 16.2</td>
</tr>
</tbody>
</table>

PPVT (Peabody Picture Vocabulary Test—III). PPVT standardized scores were better for the monolingual children. Sequencing Span scores were better for the bilingual children. (F(1, 45) = 4.8, p < .003)

Sequential Span Task

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Frog Matrix Spatial Span Task

- Recall the locations of presentations of a cartoon frog in a 3 X 3 matrix in order, starting from 2 presentations in a series.

Response Time

- Monolingual
- Bilingual

Mean RT (ms)

Error Rate

- Monolingual
- Bilingual

Error Rate (%)