

**Key Predictions**

1. Relationship between processing speed and executive control varies with age. Complex processing speed measures correlate with executive control in young adults, but simpler measures will correlate at ends of lifespan.

2. Choice of processing speed measure will influence conclusions about executive control. Complex processing speed measures will underestimate age-related change.

**Participants**

71 children (M = 12.8 years old, range 8-16)
24 young adults (M = 23.9 years old, range 19-30)
48 old adults (M = 71.5 years old, range 60-85)

**Processing Speed Measures**

In order of complexity (least to most):
- Box Completion
- Draw 4th side in an array of 3-sided boxes
- Digit Copying
- Write number above in the box
- Digit-Symbol Substitution
- Write symbol paired with number using look-up chart
- Letter Comparison
- Decide whether 3-, 6-, and 9-item strings of letters are the same or different

**Working Memory Measures**

Composite measure calculated based on five working memory tasks to reduce variance due to individual task demands.
- Wechsler Memory Scale paragraph recall
- Immediate recall two 67-word stories
- Rey-Auditory Verbal Learning Test
- Immediate recall list of 15 words five times, then a new list, then the original list again
- Card Rotations
- Determine if a series of shapes are the same (rotated) or different (mirror image)
- Backward Digit Span
- Recall digits of digits in reverse order
- Coordinative-Sequential Complexity
- Solve arithmetic problems with 3 operands

**Demands Across Increasingly Complex Processing Speed Measures**

<table>
<thead>
<tr>
<th>Processing Speed Measure</th>
<th>Working Memory</th>
<th>Decision-Making</th>
<th>Response Selection</th>
<th>Pre-Existing Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box Completion</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Digit Copying</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Digit-Symbol Substitution</td>
<td>Moderate</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Letter Comparison</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

**Processing Speed Choice Influences Estimates of Age-Related Change**

Estimates of age-related change in working memory are larger when simpler processing speed measures are used.

<table>
<thead>
<tr>
<th>WM Residual Regressing On</th>
<th>ΔR²</th>
<th>F for Δ</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter Comparison</td>
<td>.079</td>
<td>8.0</td>
<td>1.94</td>
</tr>
<tr>
<td>Digit Symbol Substitution</td>
<td>.028</td>
<td>2.9</td>
<td>1.93</td>
</tr>
<tr>
<td>Digit Copying</td>
<td>.008</td>
<td>0.8</td>
<td>1.92</td>
</tr>
</tbody>
</table>

Only the less complex Box Completion leaves age-related variance to be explained by WM.

**Discussion**

- The assessment of cognitive processes and age-related changes is complicated by variations in how much different processing speed measures tap executive control processes, at different points in development.
- Caution must be used when selecting processing speed measures with children, because of high risk that executive control skills such as goal maintenance will be needed to complete them.
- Simpler processing speed measures such as prosaccade latency, offset reaction time, and horizontal line marking may be preferable in developmental research.

**References**


**Contact**

Questions can be sent to ncepeda@yorku.ca

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**See Also**