Studies of Processing Speed in Children with Cerebral Palsy

Adapted Cognitive Assessment Lab (ACAL)

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Factor Model of Processing Speed

O’Connor & Burns (2003)

- **General Speed of Processing** – General factor; speed to perform simple and complex tasks.
- **Perceptual speed** – Matching/coding type tasks.
- **Visualization speed** – Length of stimulus exposure required to make decision (IT tasks included, mental rotation included).
- **Decision time** – Time required to make a simple decision based on sensory info (less clear factor).
- **Movement Time** – Comes out of reaction time tasks that attempt to tease movement from decision time.
Inspection Time

- Inspection time (IT) is a very simple information processing construct that is measured by an individual’s ability to perceive aspects of a stimulus given a very brief time limit.

- IT is generally thought to be associated with a Visualization Speed factor of PS; however, there is some controversy about whether IT is measuring speed of sensory processing versus post-sensory encoding.

- That said, IT measures appear to offer the unique opportunity to look at an aspect of early PS without the confounds of reaction time, paper/pencil or verbal responding.

- IT is associated with many higher level cognitive processes
Visual Inspection Time Task
Training for Participation

- The IT task is too complex for some participants to immediately grasp; therefore, a series of training steps have been developed.

- Training steps are conceptual and proceed in a natural progression of cognitive complexity.

- Step-wise training provides data to characterize the performance of children who are not able to complete the formal IT task.
• Flexibility to determine on-screen duration (OSD) of target stimulus (starting point) for each individual child.

• 3 correct responses – shorten OSD; 1 incorrect response – lengthen OSD.

• Titration of IT is determined by 8 step-wise reversals of on-screen duration.

(Wetherill & Levitt, 1965)
Previous evidence of slowed PS in children with CP, confounded by motor demands of instruments;

This study evaluated IT in children with diagnoses of CP relative to typically developing peers, and examined associations between IT and traditional graphomotor measures of PS (WISC-III).

**Demographic and developmental characteristics by Group**

<table>
<thead>
<tr>
<th>Variable</th>
<th>CP (n=89)</th>
<th>TD (n=38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>11.5 (2.5)</td>
<td>10.9 (2.6)</td>
</tr>
<tr>
<td>Gender (% male)</td>
<td>60.5%</td>
<td>49.4%</td>
</tr>
<tr>
<td>PPVT-III</td>
<td>102.1 (16.9)</td>
<td>108.1 (16.1)</td>
</tr>
<tr>
<td>Gestation (weeks)</td>
<td>32.8 (5.9)*</td>
<td>37.9 (3.2)</td>
</tr>
<tr>
<td>Birth Weight (lbs)</td>
<td>4.6 (2.5)*</td>
<td>7.0 (1.7)</td>
</tr>
<tr>
<td>History of seizure</td>
<td>17 %*</td>
<td>1.0 %</td>
</tr>
</tbody>
</table>
Results

- WISC-III speed task performances were significantly negatively correlated with the IT tasks in the CP group.
- WISC-III PS – IT correlations in the TD group were not significant.
Inspection Time & ADHD Symptoms (Shank et al., 2010)

• Objective: To examine between-groups differences in the associations processing speed assessed with an inspection time task and ADHD symptoms.

• Results
  – Children with CP exhibited significantly slower processing speed and more ADHD symptoms than controls.
  – Significant associations between inspection time and ADHD symptoms were found only in the control group.

Table 3
Pearson Bivariate Correlations Between CPRS–R and Inspection Time Variables by Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspection time</td>
<td>—</td>
<td>.09</td>
<td>.16</td>
</tr>
<tr>
<td>Inattentive</td>
<td>.48*</td>
<td>—</td>
<td>.62*</td>
</tr>
<tr>
<td>Hyperactive–Impulsive</td>
<td>.44*</td>
<td>.67*</td>
<td>—</td>
</tr>
</tbody>
</table>

Note. CP group correlations are above the diagonal and control correlations are below the diagonal. CPRS–R = Conners’ Parent Rating Scale—Revised: Long Version; Inattentive = CPRS–R DSM–IV Inattentive subscale; Hyperactive–Impulsive = CPRS–R DSM–IV Hyperactive–Impulsive subscale.

**p < .01.
Inspection Time: Summary

- Preliminary evidence that children with cerebral palsy at high GMFCS levels, show evidence of slowed PS, with performance falling approximately a standard deviation below peers;
- Preliminary evidence suggests that modified/accessible visual Inspection Time task yields comparable group level scores;
- Preliminary evidence suggests gains in PS with age;
- Evidence that IT and ADHD symptoms, assessed with standard rating scales, dissociate in children with ADHD.
Future Research

- Psychometric studies of IT tasks: Reliability and validity
- Moderators of IT performance on standard versus AT tasks
- Effects of fatigue on IT performance
- Other study populations: Dystrophin-related Muscular Dystrophy
- Medication effects?
ACAL Research Team

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