



University of Michigan
Health System

Studies of Processing Speed in Children with Cerebral Palsy

Adapted Cognitive Assessment Lab
(ACAL)

*Department of Physical Medicine and Rehabilitation
University of Michigan*

*Funded by the National Institutes of Health, the U.S. Department of Education,
and the Mildred Swanson Foundation*



University of Michigan
Medical School



Factor Model of Processing Speed

O'Connor & Burns (2003)

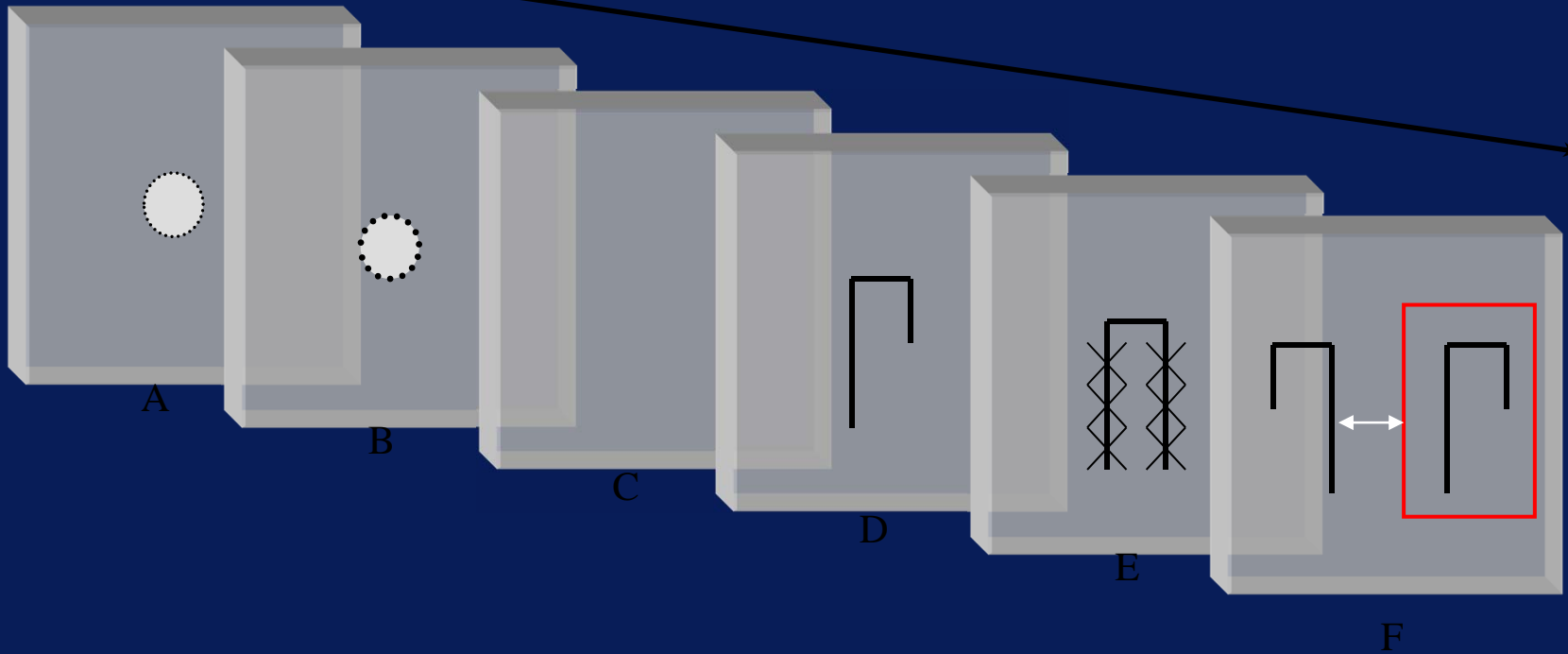
- General Speed of Processing – General factor; speed to perform simple and complex tasks.
- Perceptual speed – Matching/coding type tasks.
- Visualization speed – Length of stimulus exposure required to make decision (IT tasks included, mental rotation included).
- Decision time – Time required to make 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**

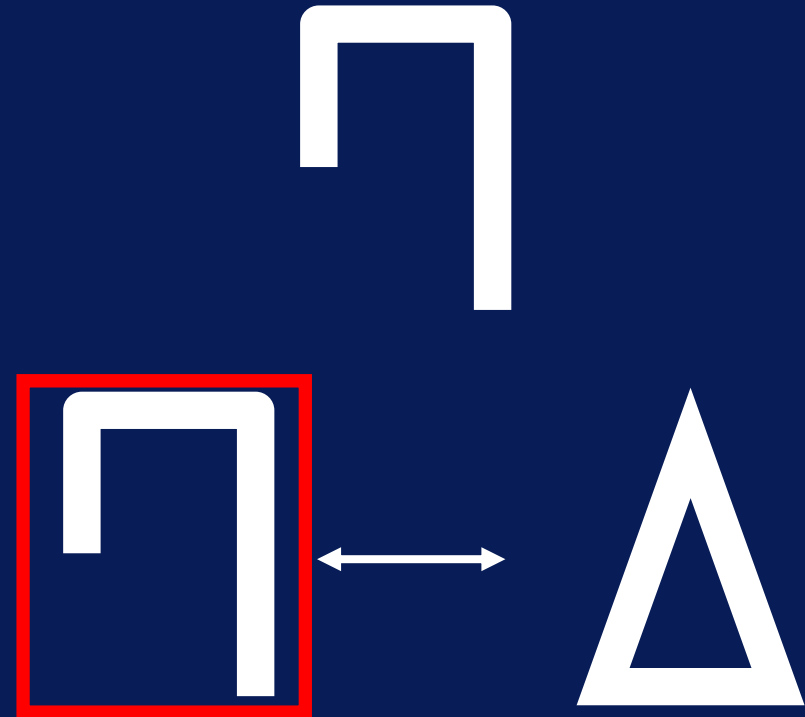
Visual Inspection Time Task

time



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.

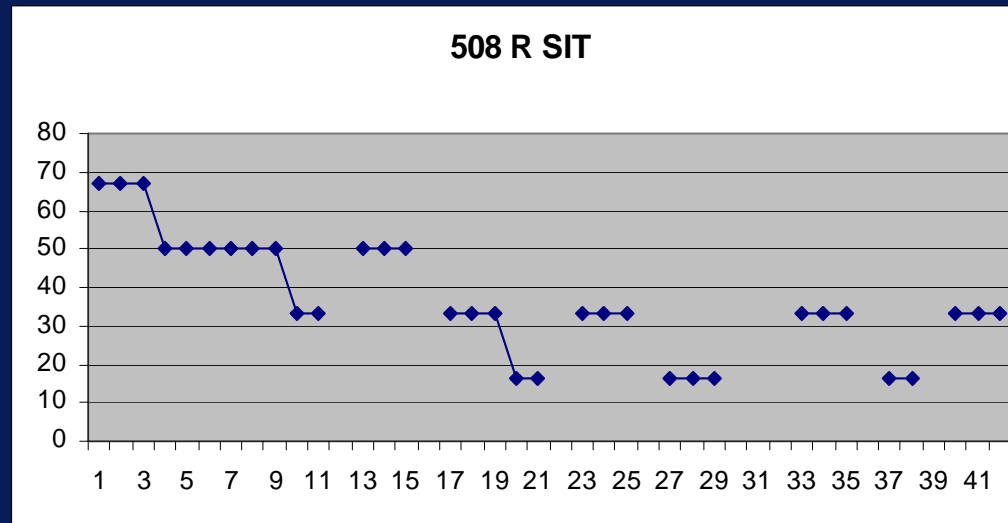




University of Michigan
Health System

Inspection Time Stepwise Procedure

(Wetherill & Levitt, 1965)



- 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.

Visual Inspection Time and Graphomotor Processing Speed in Children With Cerebral Palsy Kaufman et al. (2010)

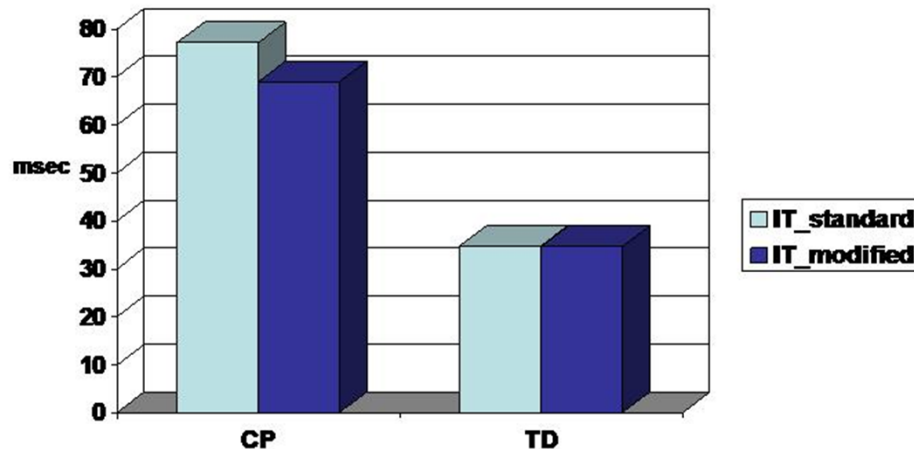
- Previous evidence of slowed PS in children with CP, confounded by motor demands of instruments;
- This study evaluated IT in children with diagnoses of CP relative to typically developing peers, and examined associations between IT and traditional graphomotor measures of PS (WISC-III).

Demographic and developmental characteristics by Group

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

Results

Standard and Modified Inspection
Time by Group



- 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

Variable	1	2	3
1. Inspection time	—	.09	.16
2. Inattentive	.48**	—	.62**
3. Hyperactive–Impulsive	.44**	.67**	—

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

University of Michigan

- Research Administration Office
 - Donna Omichinski, B.A.; Study Coordinator
- Core Faculty
 - Seth Warschausky, Ph.D.
 - Marie Van Tubbergen, Ph.D.
 - Jacqueline Kaufman, Ph.D.
- Post-doctoral Fellows
 - Lindsey Felix, Ph.D.
 - Laura Shank, Ph.D. (2008-2010)
 - Stacie Leffard, Ph.D. (2008-2010)
- Collaborators
 - Rita Ayyangar, M.D., MPH
 - Edward Hurvitz, M.D., Chair PM&R
 - Lynn Driver, M.S.; SLP

Mary Free Bed Rehabilitation Hospital

- Jacobus Donders, Ph.D., ABPP
- Shana Asbell, Ph.D.; Post-doctoral Fellow



The ACAL Project Website

<http://www.med.umich.edu/pmr/acal/index.htm>

For more information contact:

Donna Omichinski

ANAC-Project@umich.edu

