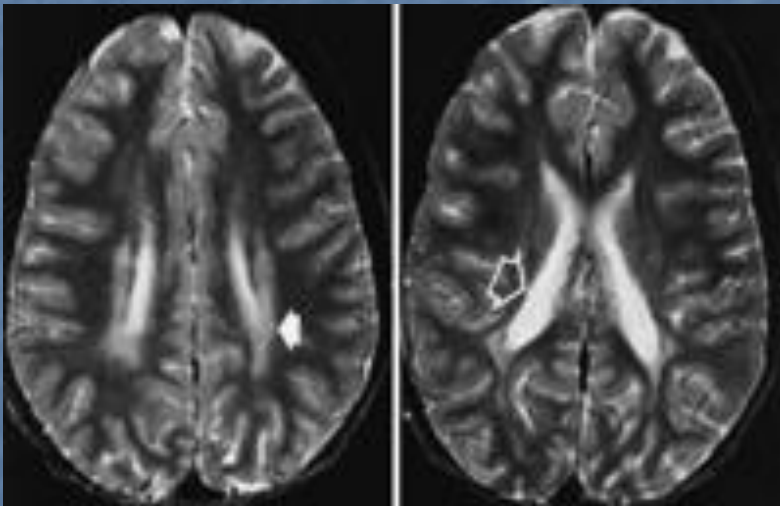


Neuropsychology of Cerebral Palsy: Adapted Cognitive Assessment Laboratory Studies



Seth Warschausky, Ph.D.

***Department of Physical Medicine and
Rehabilitation; University of Michigan***

ACAL Research Team

- **University of Michigan**
 - **Core Faculty**
 - Jacqueline Kaufman, Ph.D.
 - Marie Van Tubbergen, Ph.D.
 - Seth Warschausky, Ph.D.
 - **Collaborators**
 - Rita Ayyangar, M.D., MPH
 - Lynn Driver, M.S.; SLP
 - Judith Greenbaum, Ph.D.; Consultant
 - **Research Administration Office**
 - Nicole Miller, B.A.; RA
 - Donna Omichinski, B.A.; Project Coordinator
- **Mary Free Bed Rehabilitation Hospital Collaborators**
 - Jacobus Donders, Ph.D., ABPP; Co-I
 - Shana Asbell, Ph.D.; Post-doctoral Fellow

Neuropsychology of CPs

- Limited study and understanding of neuropsychological risks associated with CP subtypes, and very few studies that focus on specific neuropsychological domains; i.e., attention, executive functions, memory, visuospatial functions
- Larger focus on neuropsychological risks of populations with history of low and very low birth weight and PVL, but not necessarily CP

CP Subtypes & Neuropsychological Domains

- **Spastic diplegia**
 - **Visuoperceptual impairments associated with evidence of periventricular leukomalacia**
 - **Possible multifactorial etiology for visuoperceptual impairments including developmental effects of impaired vision, oculomotor and general motor impairments**
- **Dyskinetic**
 - **Some evidence of lower risk for impairments in specific domains including visuospatial, memory and executive function**
- **Hemiplegia**
 - **36% with Specific Learning Disability**

Inhibitory control

(Christ, White, Brunstrom, Abrams, 2003)

- “High functioning” children with bilateral spastic CP typically associated with PVL
- Non-significant associations between IQ and inhibitory control
- Significant impairments in inhibitory control and processing speed

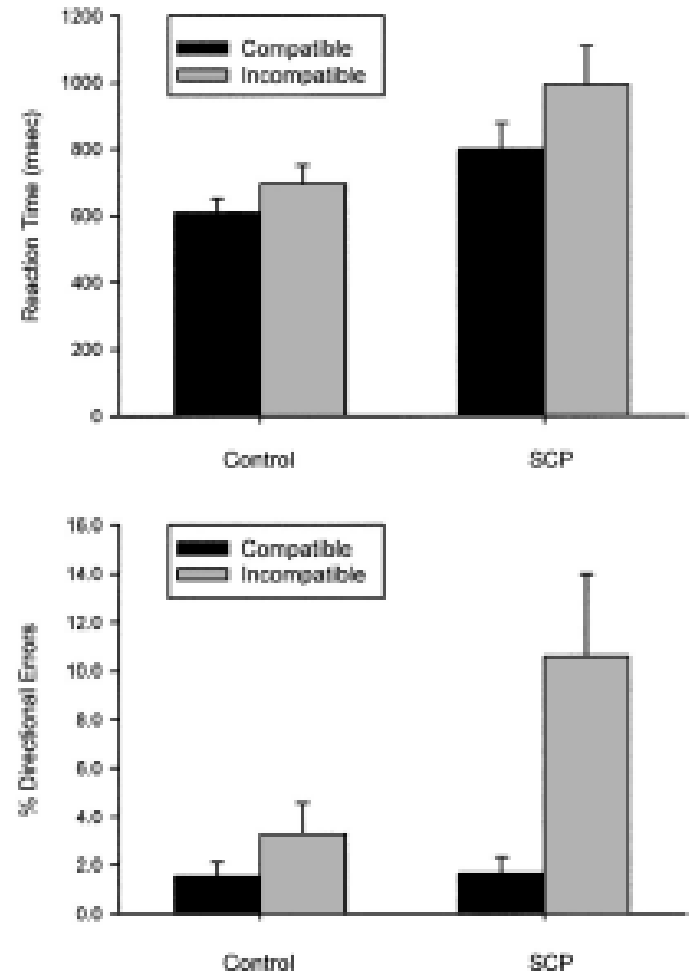


Figure 1. Mean reaction times (top) and mean directional error rates (bottom) on the stimulus-response reversal task. Results are shown as a function of group (control and spastic cerebral palsy [SCP]) and condition (compatible and incompatible). Error bars represent the standard error of the mean.

Reading Acquisition

- Much research showing that anarthria or severe dysarthria does not preclude developing phonological processing skill
- Sandberg & Hjelmquist (1997), using nonstandardized tasks, showed that among nonvocal children with CP, ages 8 - 19, those who could read had higher phonological processing scores than the nonreaders.

- **Among 5-13 year olds with cerebral palsy, 20% were either unable to speak or not comprehensible to an unfamiliar person**
- **29% required help for most tasks and 16.2% required help with all tasks**
- (Study-2, N.L.T. *NLTS2 data tables*. 2003. Available from: <http://www.NLTS2.org>)

Recognition of the limitations of traditional neuropsychological assessment instruments and models

- **Long-standing concern that traditional cognitive measures are not accessible to children with significant communicative and motoric impairments**
(Allen, 1958; Byrne, Dywan, Connolly, 1995; Sabbadini, Bonanni, Carolesimo & Caltagirone, 2001; Tracht, 1948)
- **Neuropsychological knowledge derived from the typically developing (TD) population does not always apply to children with CP. For example, in TD children, articulation rate is associated with memory span - doesn't hold for children with CP.**
(Hulme, Thomson, Muir, & Lawrence, 1984; White, Craft, Hale, Park, 1994)

Addressing limitations of traditional testing: Adaptations from other laboratories

- **Event-related Potential (ERPs):** Byrne et al. (1995) assessed single word receptive vocabulary using congruent and incongruent computerized picture-word pairs (PPVT). Higher N400 negativity to mismatched pairs.
- **Dichotomous Choice:** Sabbadini et al. (2001) used dichotomous choice formats for neuropsychological evaluations that included measures of phonological processing, grammatical comprehension, memory and reasoning.

The ACSESS Project

University of Michigan

Western Michigan University

United Cerebral Palsy Association of
Michigan

Washtenaw Intermediate School District

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Objectives of the ACSESS Project

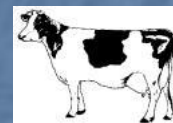
- Meet national initiatives to find more effective ways of assessing educational progress of children with special needs;
- Increase awareness of the limitations of traditional assessment instruments in accurately assessing the skills and abilities for children who have significant motoric, sensory or communicative impairments;
- Combine the developments of assistive technology, rehabilitation engineering and computerized and alternate assessment.

Van Tubbergen et al. (2008)

Skill Description

Forced Choice

Yes / No



Responsiveness

Will notice and attend, at least briefly, to novel stimulus

Preference

Will communicate a general, affective response regarding personal preference

"Which picture do you like best?"

"Do you like this dog?"

Preference-Advanced

Will communicate a specific response signal regarding personal preference

"Which picture do you like best?"

"Do you like this dog?"

Directed

Will communicate a specific response signal to questions unrelated to personal desires

"Which one is a fish?"
"Which one is a dog?"

"Does this dog have a nose?"
"Is this dog black?"

Prediction

Will communicate a specific response signal to questions requiring indirect application of knowledge

"Which one does not show an animal?"
"Which one barks?"

"Is this an animal?"
"Can he fly?"

Modified Test Administration Using Assistive Technology: Preliminary Psychometric Findings

Instruments and Procedures

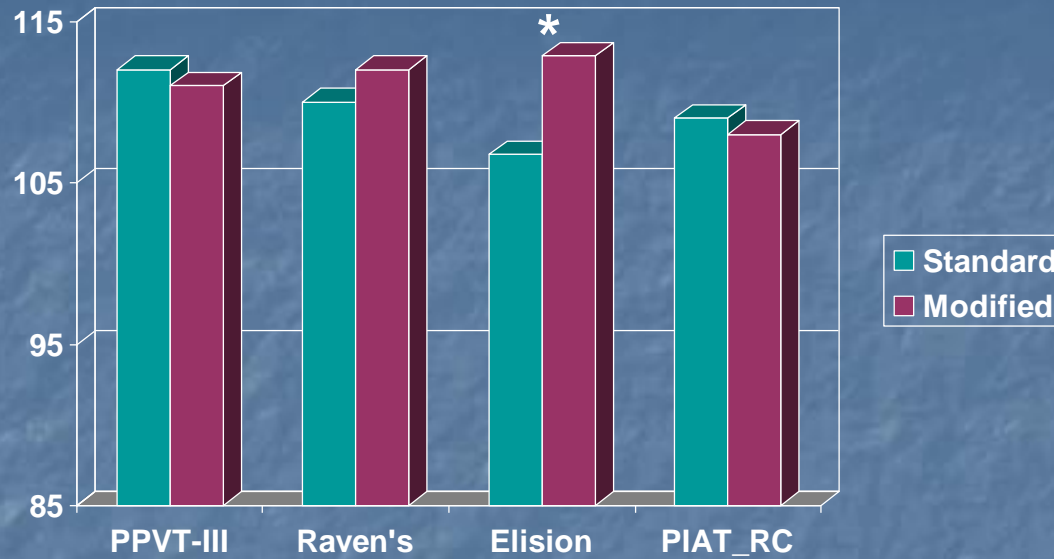
- PPVT-III & Raven's Coloured Progressive Matrices tests provide estimations of overall intellectual ability.**
- CTOPP Elision provides information on phonemic awareness, an important predictor of reading acquisition.**
- PIAT-R/NU Reading Comprehension provides an estimation of current reading ability.**

- Standard and Adapted versions of each test were administered in counterbalanced order.**

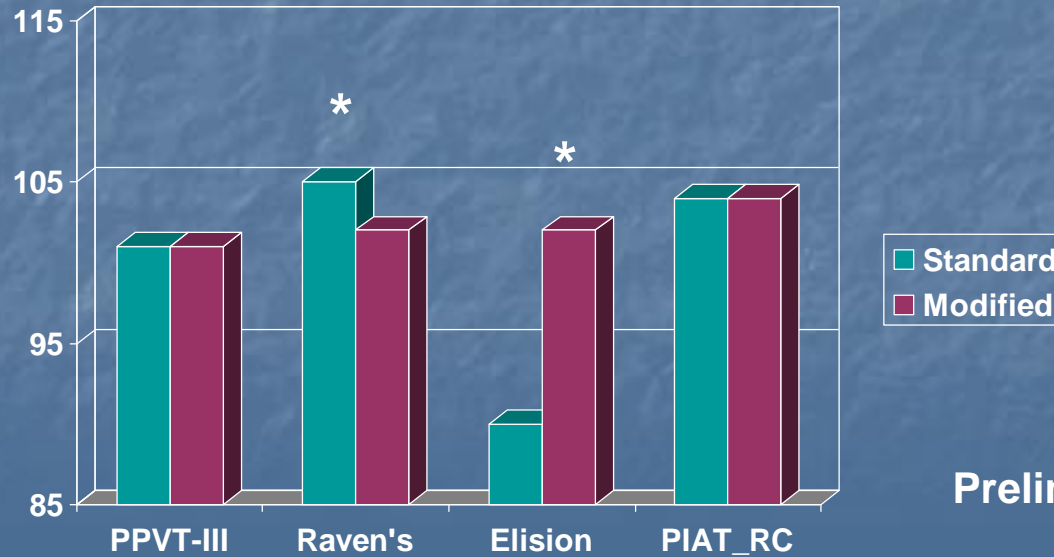
- Children were randomly assigned to either a HeadMouse® or pressure sensitive switch for AT access in the modified versions of tests.**

Standard and Modified Test Scores by Group

TD



CP



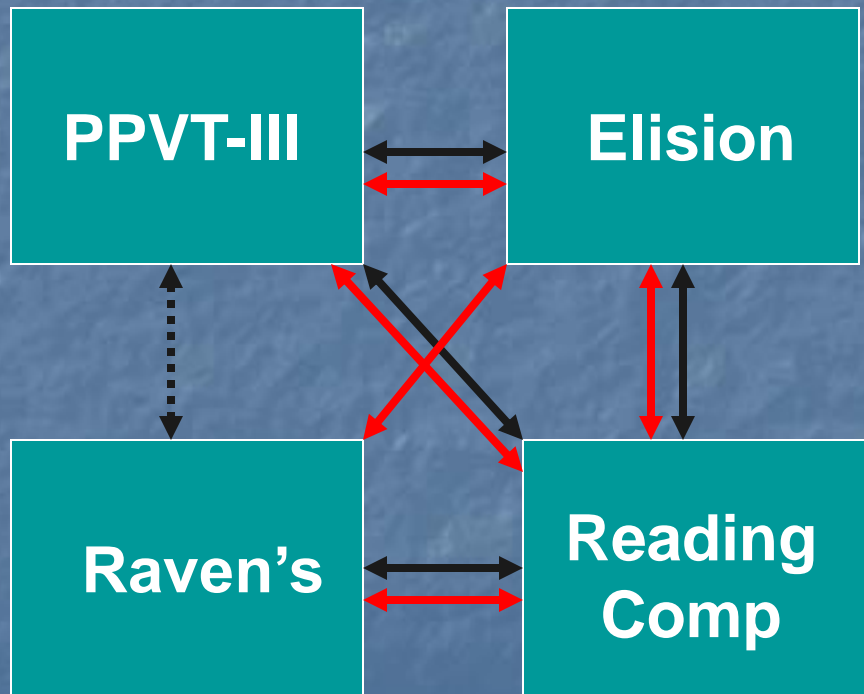
Preliminary findings

Associations between Test Scores

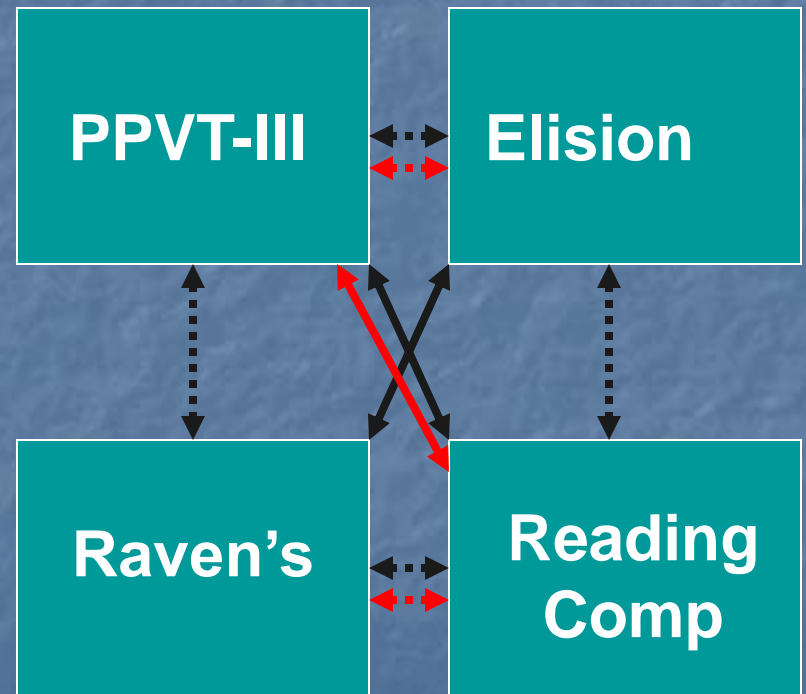
Standard = Black

Modified = Red

Typically Developing



Cerebral Palsy



Preliminary findings

Conclusions

- Preliminary evidence that modifying neuropsychological tests to make them more accessible does not necessarily alter psychometrics
 - with notable exceptions, including test of phonological awareness and possibly types of IQ testing.
- Poised for more comprehensive studies of
 - the neuropsychology of the CPs
 - phonological awareness and reading acquisition
 - medication effects
 - complex relations between cognitive capabilities and use of assistive technology.
 - The utility of findings for educational planning

The ACAL Project Website

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

For more information contact:

ANAC-Project@med.umich.edu