



# Studies of Cognition in CP

## *Adapted Cognitive Assessment Laboratory Update*

**Seth Warschausky, Ph.D.**

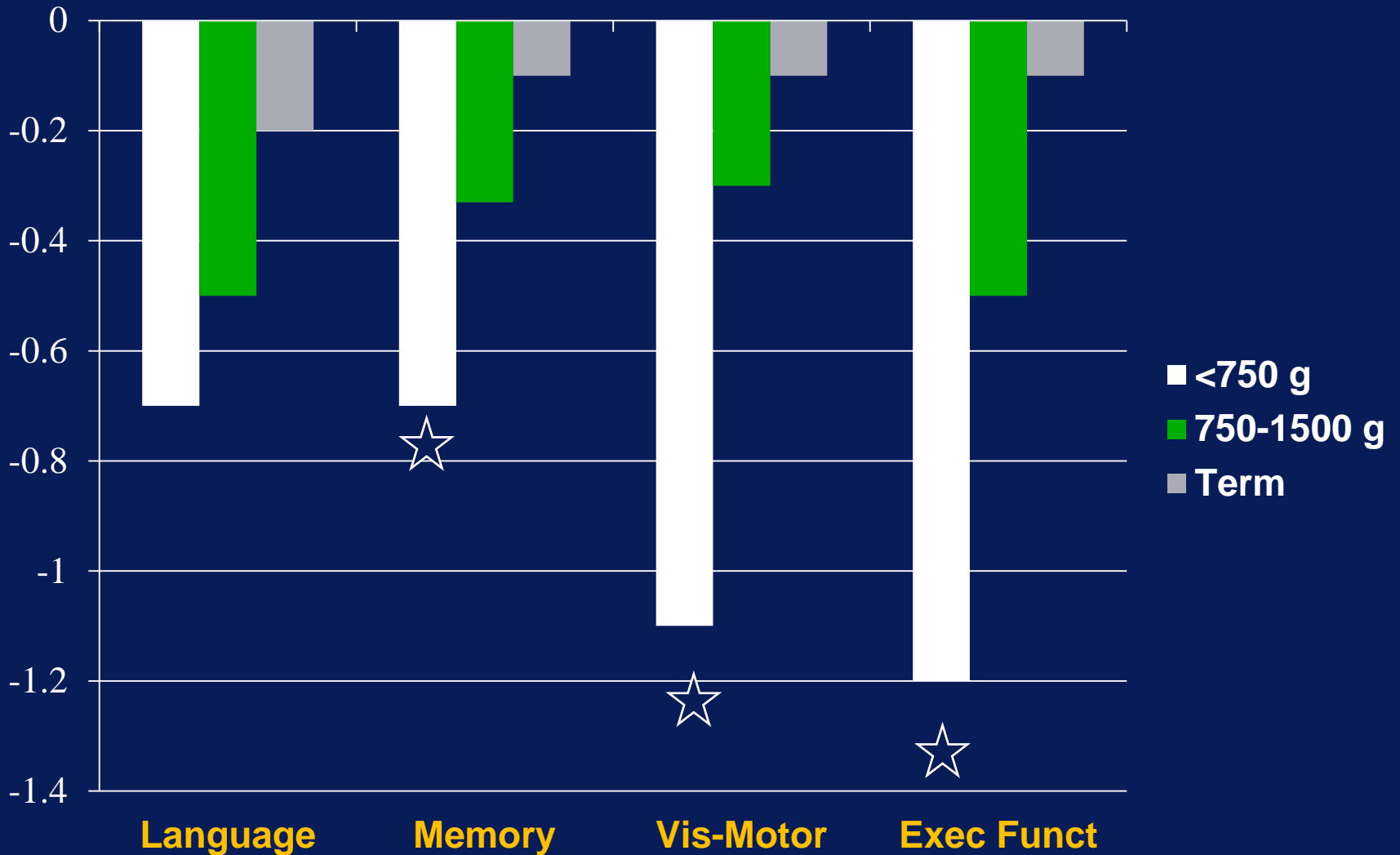
*Department of Physical Medicine and Rehabilitation  
University of Michigan*

# “Neuropsychology of Cerebral Palsy”

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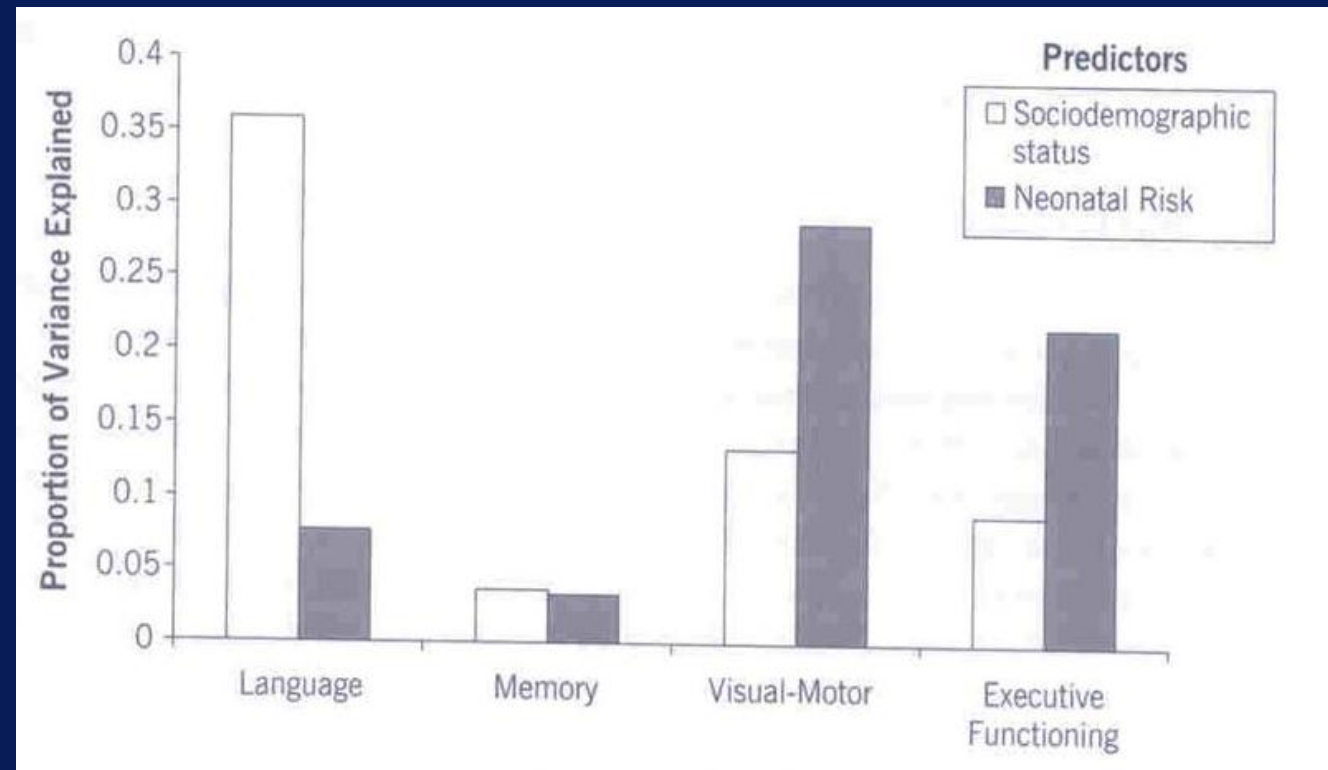
- **Preterm Birth/ VLBW**, with and without CP, entails risk for cognitive impairments
  - Motor, Memory, Attention and Executive dysfunction
- **Neuropathology**, with or without CP, entails risk for impairments
  - PVL: Attention and executive dysfunction; visuospatial impairments
- **Epilepsy, with or without CP**, entails risk for impairments
  - Attention and executive dysfunction; Memory impairments
- **Other comorbidities and conditions that affect cognitive development and status (e.g., sensory impairments, sleep disturbance, multiple birth)**

# Neuropsychological Outcomes of VLBW at Age 16 (Taylor, 2009)



# *Biological versus Sociodemographic risk in VLBW sample (Taylor et. al., 2004; Taylor, 2009)*

From regressions in which BW and Neonatal Risk Index are entered, followed by SES and Race



- **Information Processing Speed (PS)**
  - Sensitive to change in neurological status
  - Contributes to higher level cognitive functions
  - Most robust sequela to brain injury
- **Standard measures of PS rely on rapid motor responses**
- **Inspection time is a measure of PS that is not dependent on response time**

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# Standard & Adapted IT tasks

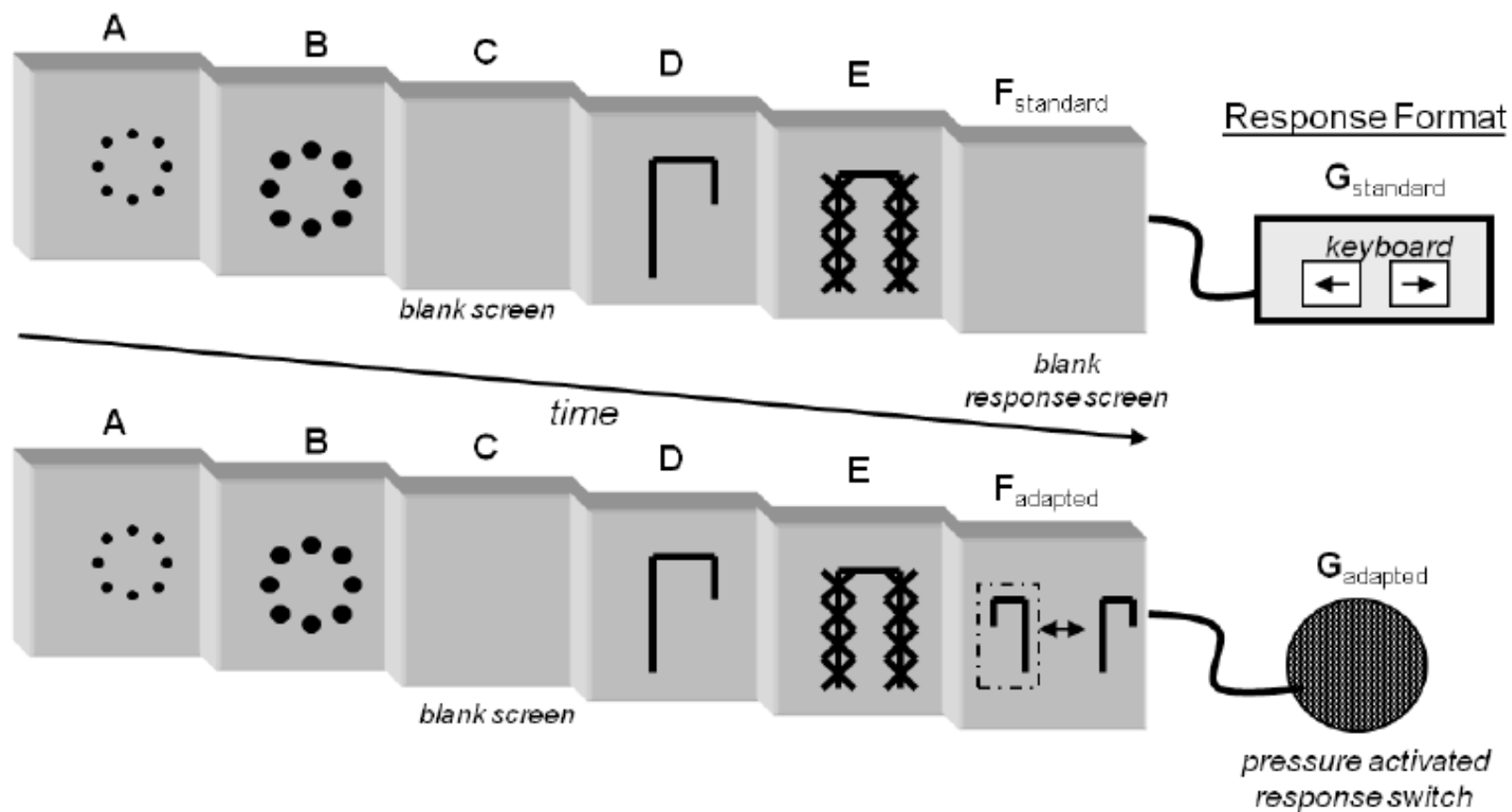
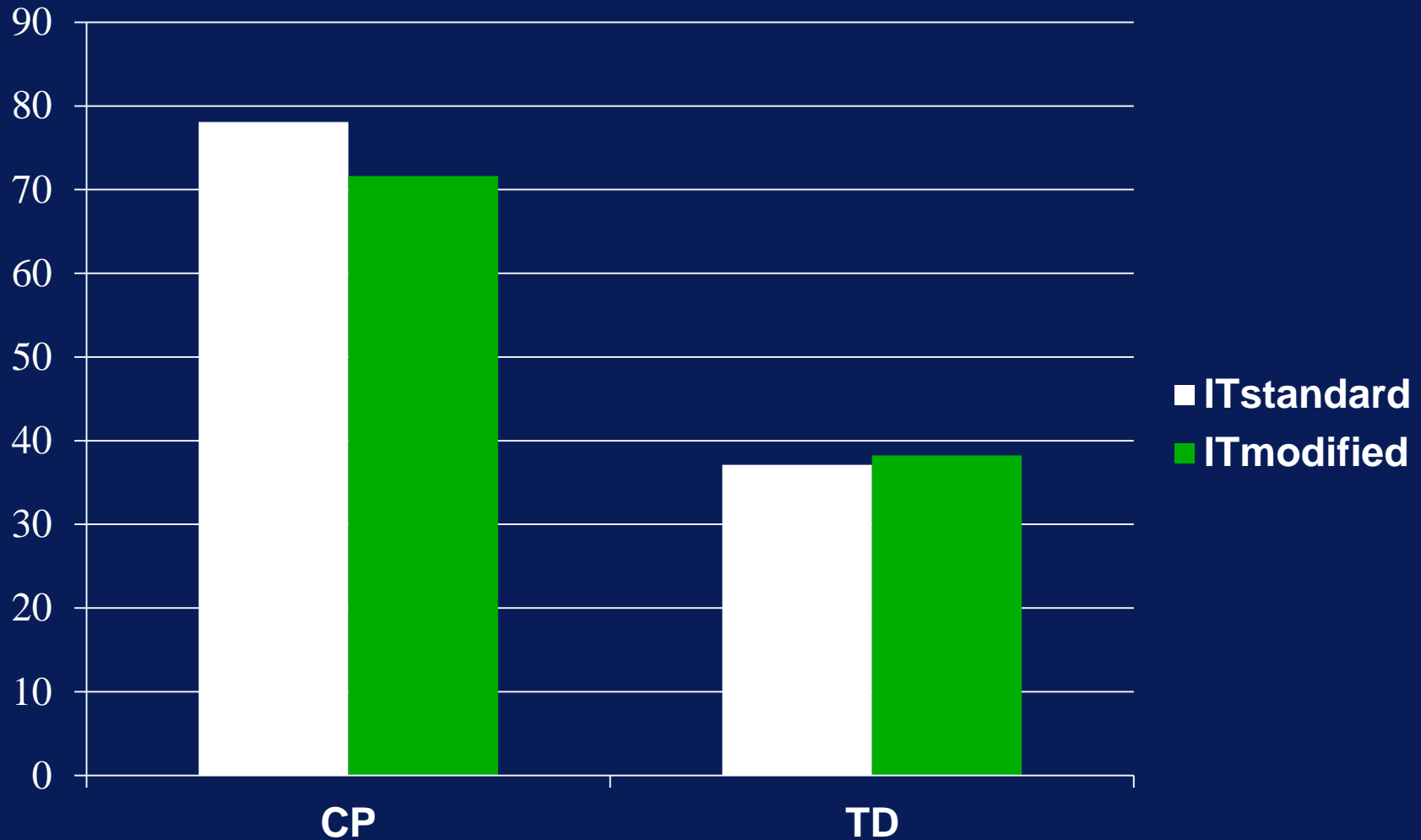


Figure 1

# Participants

	<u>CP (n=66)</u>	<u>Control (n=119)</u>
Age	11.33 (2.32)	11.34 (2.51)
Gender*	66.2% Male	50.0% Male
SES (Hollingshead)	3.59 (1.04)	3.59 (1.15)
Seizure History**	20.3%	0.9%
Birth Weight (grams)**	2061 (1153)	3223 (745)
PPVT-III**	100.34 (17.86)	108.21 (15.36)

# Standard and modified IT threshold by group

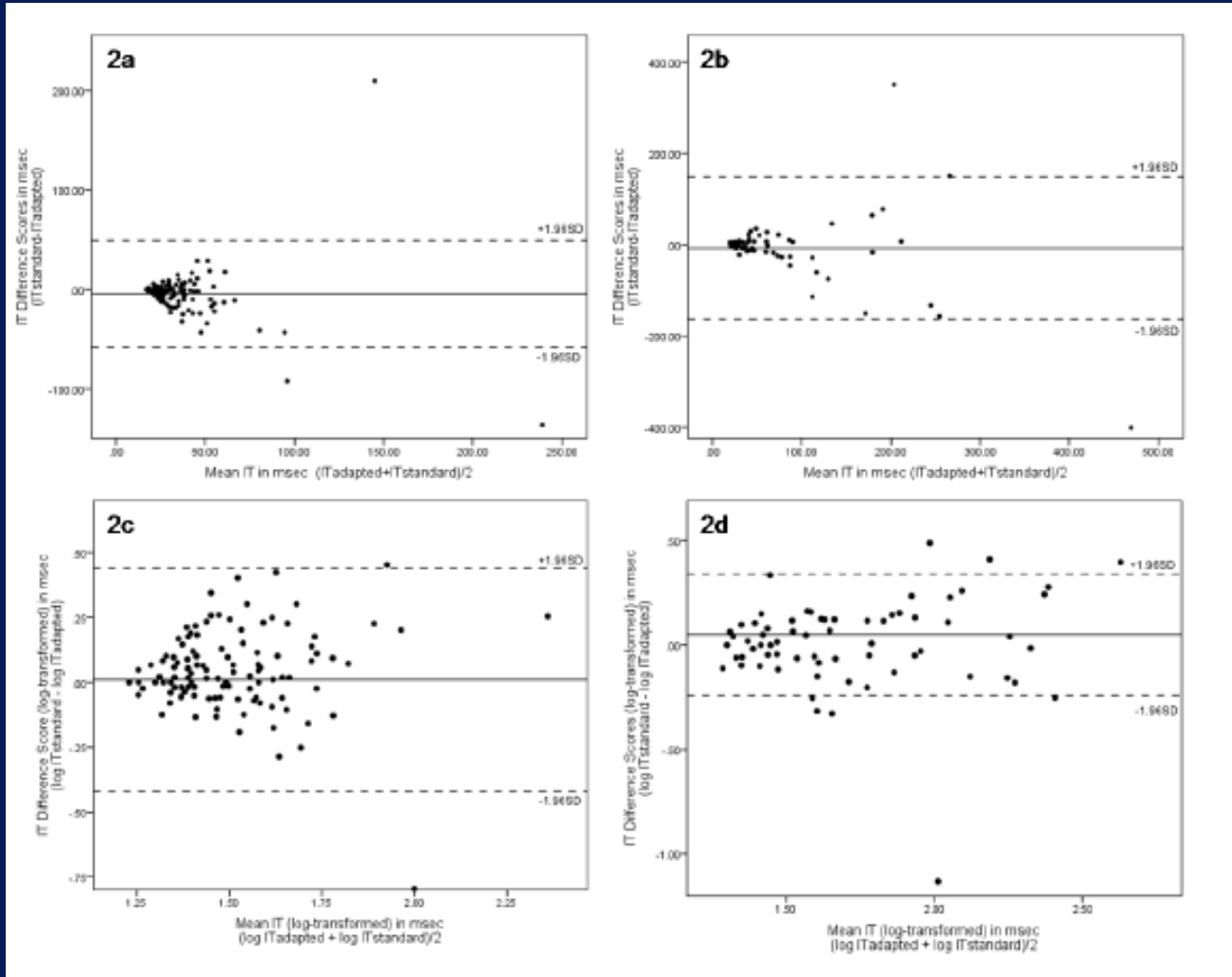




# Bland Altman plots showing value of log transformed scores in sample with CP

TD

CP



# *Summary*

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- **The Group with CP had slower IT than the Control Group independent of test version.**
- **Bland-Altman plots showed that at higher mean IT thresholds, greater discrepancies between test version scores were observed. Log transformations were successful in the Group with CP, resulting in moderate measurement agreement.**
- **Findings support the feasibility of developing accessible PS tests that reduce speeded motor response demands.**
- **Future test development should incorporate increased gradations of difficulty at the extremes of neuropsychological functioning to more accurately assess the performance of individuals whose conditions are associated with atypical performance levels.**

# Visual Inspection Time as an Accessible Measure of Processing Speed: A Validation Study in Children with Cerebral Palsy

Kaufman, Van Tubbergen, Donders & Warschausky

Variable	1	2	3
1. Standard Inspection Time	—	0.83**	-0.49*
2. Adapted Inspection Time	0.69**	—	-0.57**
3. WISC-III Processing Speed	-0.19	-0.21	—

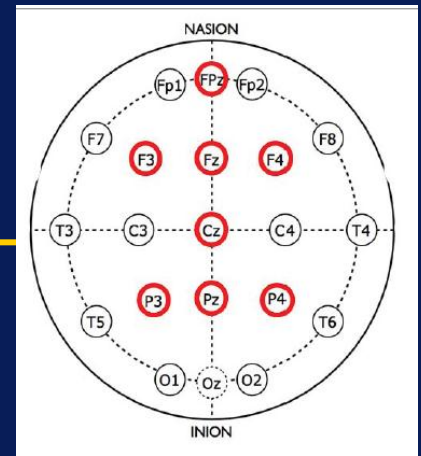
CP Group correlations above the diagonal.

In this pilot study, we investigate the potential clinical utility of an innovative assessment technique developed by Connolly et al. (1995) that uses EEG to record ERPs as test item responses, thereby bypassing the need for motor and oral responses.

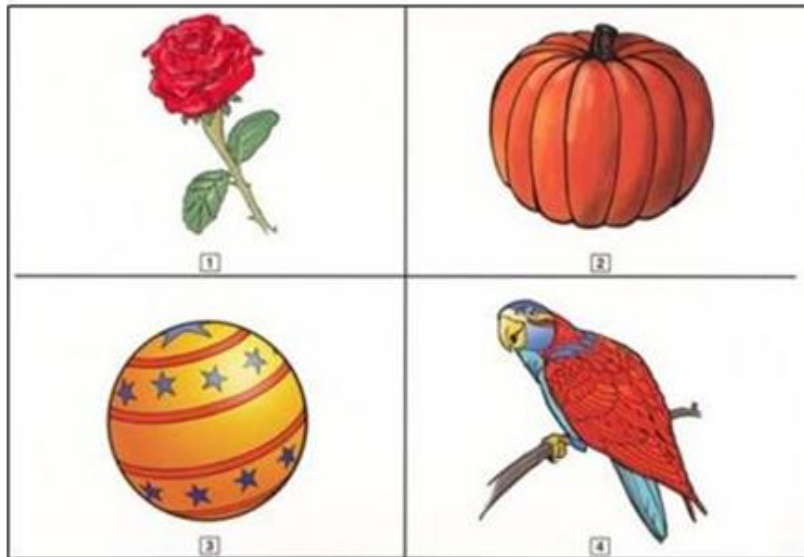
### **ERP PPVT-4**

- **Participants were presented with matching or mismatching picture-word pairs at a range of vocabulary levels.**
- **During the computerized test, EEG of the participants were recorded using eight Ag/AgCl electrodes, affixed to Fpz, F3, Fz, F4, Cz, P3, Pz and P4 (International 10-20 electrode system), with a ground and reference on the left and right ear, respectively.**

# ERP PPVT-IV Administration



a) Example of a single item on the standard PPVT-4

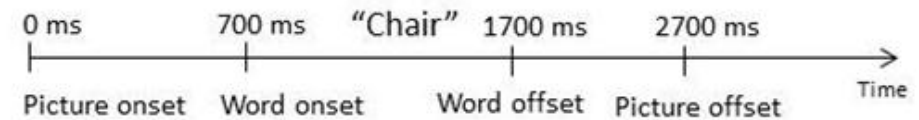
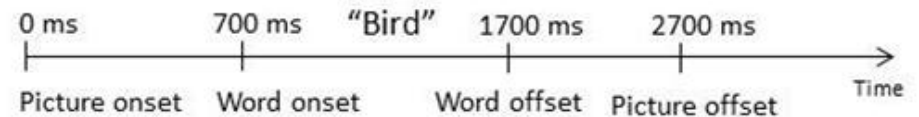


Examiner's word: "Bird"

b) Example of a single item on the computerized PPVT-4



Picture displayed on computer screen

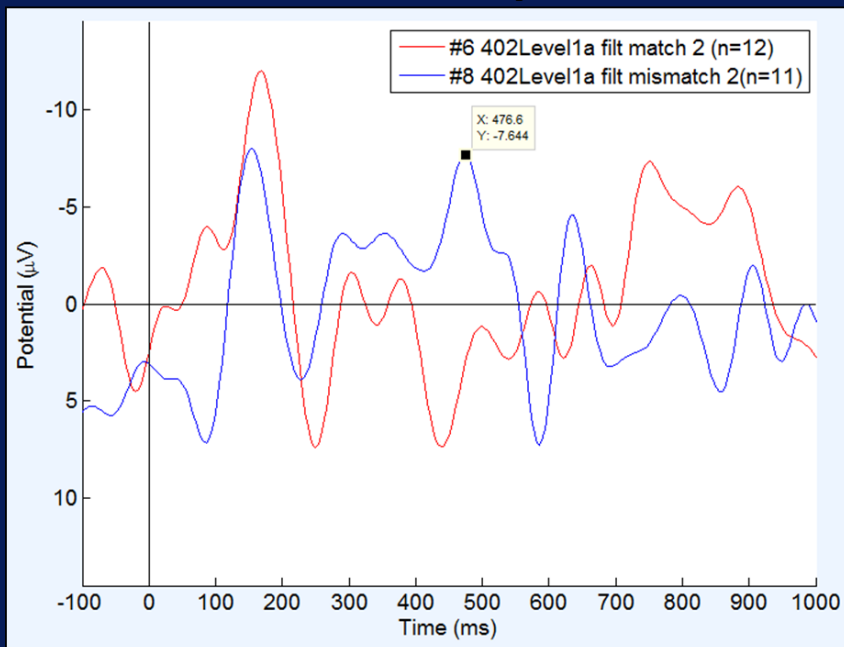


# ERP N400 Mismatch by Vocabulary level

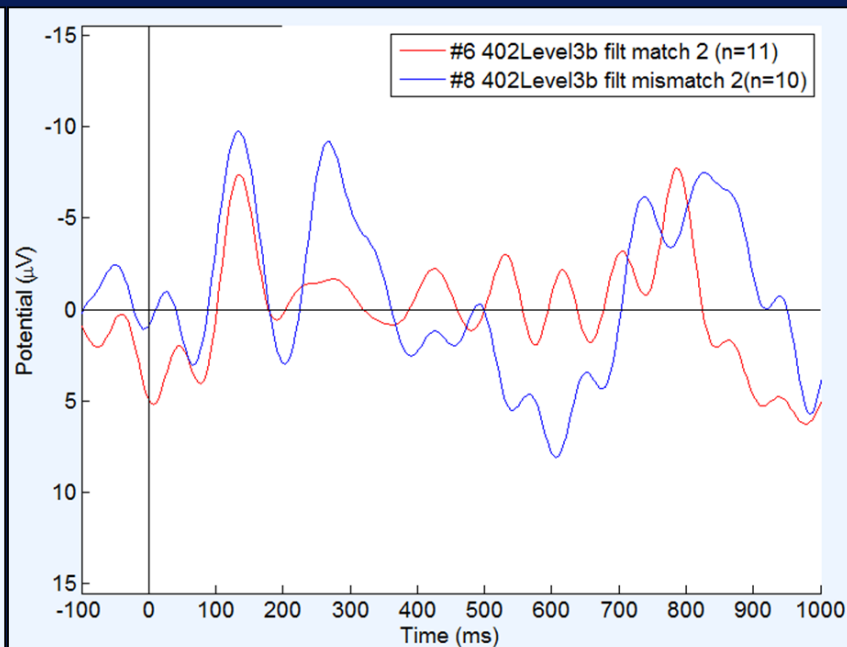
## Level 1a: N400 Present

## Level 3b: N400 absent

### Level 1a: N400 present



### Level 3b: N400 absent



# Pilot Data illustrating predicted and observed performance

- Within each level, standard PPVT-IV results were used to predict the presence or absence of an N400 in mismatch trials. For each participant, predictions were correlated with observed changes in EEG.

Table 2: Presence of predicted and observed N400 ERP. Shaded cells indicate the presence of an N400.

Participant	N400 Response	Level						
		1a	1b	2a	2b	2c	3a	3b
1	Predicted	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
	Observed	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
2	Predicted	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
	Observed	Shaded	Shaded	White	Shaded	White	White	White
3	Predicted	White	White	White	White	White	White	White
	Observed	White	White	White	White	White	White	White
4	Predicted	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded	Shaded
	Observed	Shaded	Shaded	Shaded	White	Shaded	Shaded	Shaded

# *The Future*

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- **ACAL projects continue to develop and refine accessible instruments, most notably Jacqueline Kaufman's current NIDRR-funded Working Memory study**
- **Medical and socio-demographic predictors of neuropsychological profiles**
- **Treatment effects on cognition**
- **Studies of the cognitive loads inherent in use of assistive technologies**



# *ACAL Research Team*

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## **University of Michigan**

- **Research Administration Office**
  - Donna Omichinski, B.A.; Study Coordinator
  - Janet Yoo, B.S.; Research TA
- **Core Faculty**
  - Jacqueline Kaufman, Ph.D.
  - Seth Warschausky, Ph.D.
  - Marie Van Tubbergen, Ph.D.
- **Post-doctoral Fellows**
  - Crystal Young, Ph.D.
  - Danielle Shapiro, 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

## **Mary Free Bed Rehabilitation Hospital**

- Jacobus Donders, Ph.D., ABPP
- Shana Asbell, Ph.D.



# *The ACAL Project Website*

<http://www.sitemaker.umich.edu/acal/home>

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