

# Conducting TBI Evaluations: Using Data from WAIS-IV, WMS-IV and ACS for WAIS-IV & WMS-IV

Gloria Maccow, Ph.D.  
Assessment Training Consultant

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## Objectives

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- Provide a brief description of WAIS-IV, WMS-IV, and ACS for WAIS-IV and WMS-IV.
- Use sample information to describe use of WAIS-IV, WMS-IV and ACS to answer a specific clinical question.

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## Three Batteries

- WAIS-IV, WMS-IV, and ACS were developed to be used together.
- Decisions made in the development of one instrument affected the development of other components.
- Each instrument provides unique information about the examinee.

## Applications of Batteries

### WAIS-IV and WMS-IV used for

- School based evaluations
- Disability evaluations
- Psychiatric evaluations
- Neuropsychological evaluations
- Forensic evaluations
- Medical/legal evaluations
- Competency evaluations
- Vocational Rehabilitation evaluations, etc.

## Factors to Consider

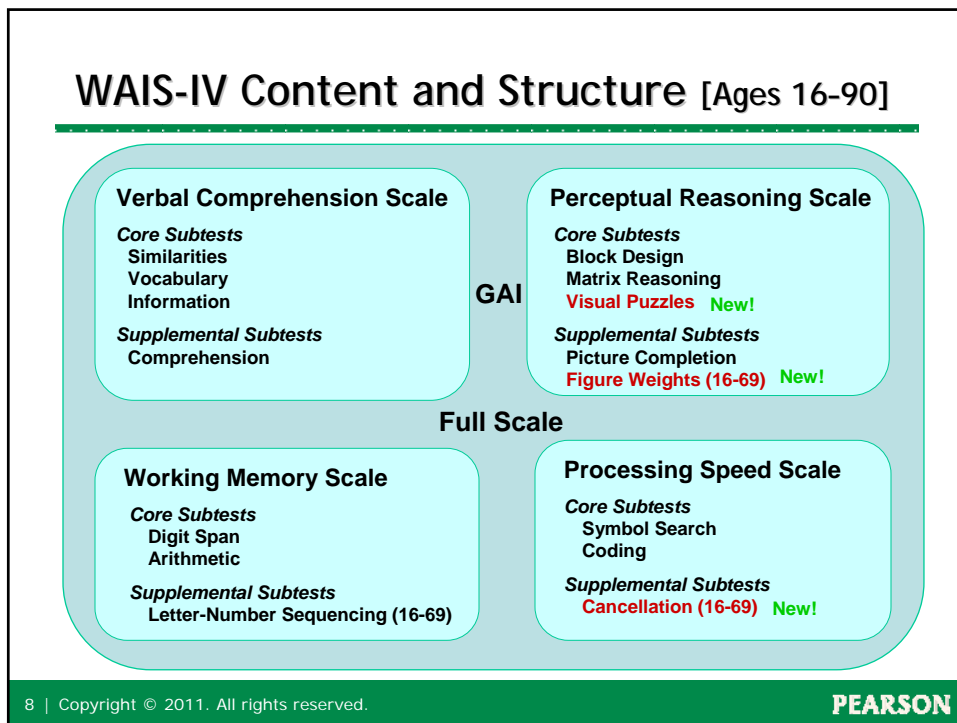
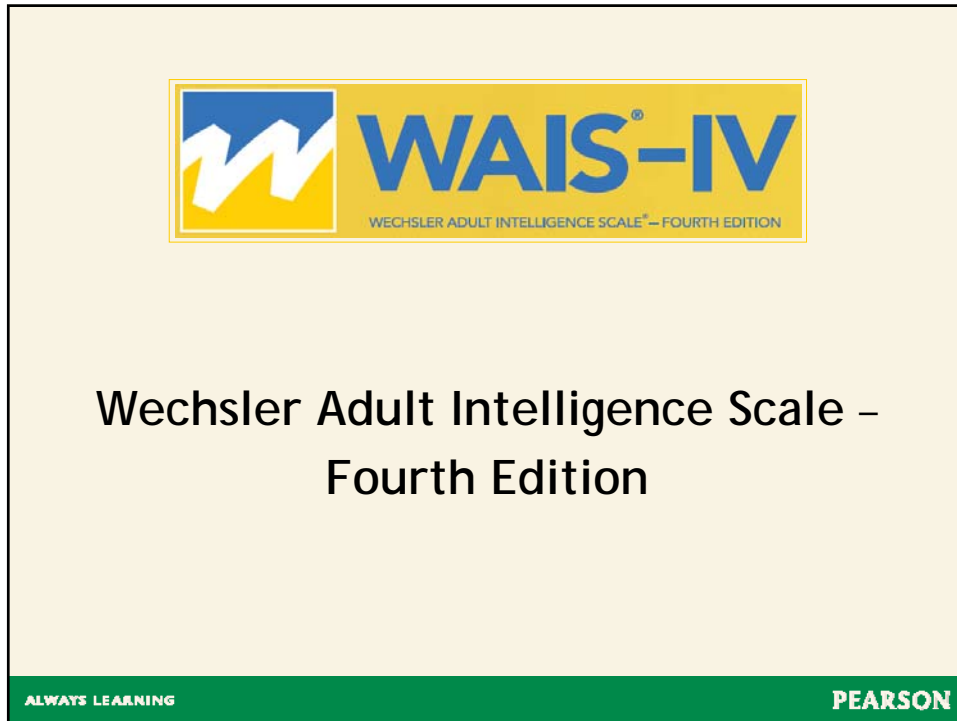
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- Difficult to build one instrument to answer all possible questions.
- Not all clinicians will need all pieces of information.
- Expectation is that clinicians will select those measures that best fit their practice and workflow.

## Factors to Consider

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- The tests were built together to allow users to better identify the nature of the underlying cognitive difficulty.
- One of the strengths of the tests is their co-norming.
- Use regression based approach to partial out overlapping variance (contrast scores).



## What is the GAI?

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- The WAIS-IV GAI provides the practitioner with a summary score that is less sensitive than the FSIQ to the influence of working memory and processing speed.
- GAI = sum of scaled scores for VCI subtests and PRI subtests

## What is the GAI?

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- WAIS-IV GAI should be used for discrepancy comparisons
  - Ability and Memory
  - Ability and achievement
- GAI is **NOT** a replacement for FSIQ

## General Ability Index

*Consider\** using the GAI if a significant and unusual discrepancy exists between

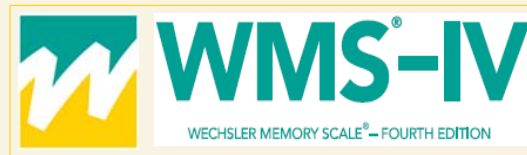
- ✓ VCI and WMI; or
- ✓ PRI and PSI; or
- ✓ WMI and PSI, or
- ✓ between subtests within WMI and/or PSI.

*Note:* The FSIQ is the most valid measure of overall cognitive ability and WM and PS are vital to comprehensive evaluation of cognitive ability.

## General Ability Index - Note!

- The GAI is used when neuropsychological deficits adversely impact performance on WM and PS.
- Impaired performance on WM and/or PS may mask actual differences between general cognitive ability (FSIQ) and other cognitive functions (e.g., memory).
- The GAI does not replace the FSIQ. Report and interpret GAI along with FSIQ.

[see WAIS-IV Technical Manual]



## Wechsler Memory Scale – Fourth Edition

**MEASURES ABILITY TO LEARN AND REMEMBER  
INFORMATION PRESENTED VERBALLY AND VISUALLY**

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## Memory and Learning

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- **Encoding:** External information is transformed into mental representations or memories and stored in STM.
- **Consolidation:** Information from immediate memory is solidified into long-term memory stores.
- **Retrieval:** Information is brought into conscious awareness.

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## WMS-IV Test Battery

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### Seven subtests:

- Logical Memory, Verbal Paired Associates, and Visual Reproduction - **retained from WMS-III.**
- Brief Cognitive Status Exam, Designs, Spatial Addition, and Symbol Span - **NEW.**

## WMS-IV Test Battery

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Logical Memory, Verbal Paired Associates, Designs, and Visual Reproduction have two conditions: the immediate condition (I) and the delayed condition (II), which are administered about 20-30 minutes apart.



## WMS-IV Batteries

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Adult Battery                      Ages 16-69

Older Adult Battery              Ages 65-90

[Also, WMS-IV Flexible Approach]

## Types of Scores

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- Primary Subtest Scaled Scores  
(mean=10, sd = 3)
- Index Scores (mean=100, sd = 15)
- Process Scores (Scaled Score or  
Cumulative Percentage)
- Contrast Scaled Scores



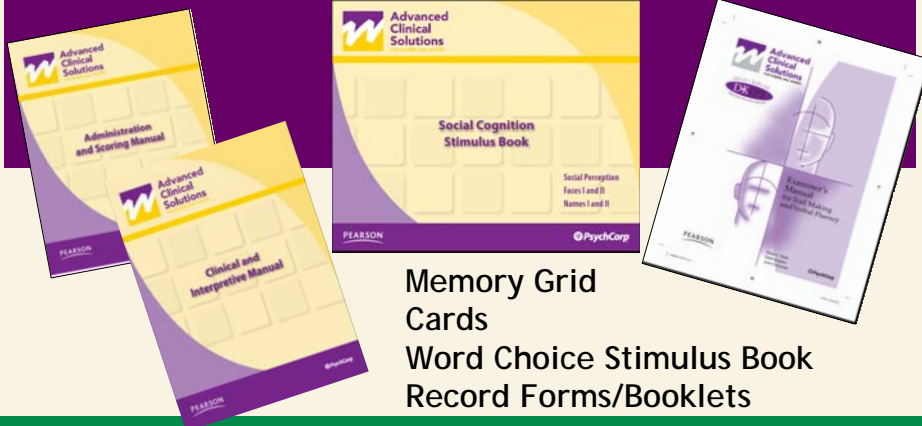
## Advanced Clinical Solutions for WAIS-IV and WMS-IV

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## Components of ACS



Memory Grid  
Cards  
Word Choice Stimulus Book  
Record Forms/Booklets

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## ACS for WAIS-IV/WMS-IV

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*Advanced Clinical Solutions for WAIS-IV and WMS-IV* is an individually administered array of tests, procedures, and scores addressing specific clinical questions and needs.

## Primary Goal of ACS

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To expand and enhance the clinical utility of WAIS-IV and/or WMS-IV through . . .

- Additional assessments, and
- Software.

## Applications of ACS

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additional *assessments* of:

- premorbid functioning
- effort
- social cognition
- executive function

A separate instrument, *Texas Functional Living Scale*, linked with the WAIS-IV and WMS-IV, can be used to assess daily living skills.

## Applications of ACS

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and *software* that delivers:

- Demographically Adjusted Norms
- Additional scores for WAIS-IV and WMS-IV
- Reliable Change scores

## Premorbid Functioning

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### *Test of Pre-Morbid Functioning (TOPF)*

- Revision of the Wechsler Test of Adult Reading (WTAR).
- Provides an estimate of premorbid intellectual functioning.

## Test of Premorbid Functioning

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- Uses Atypical Grapheme-Phoneme translation to measure word knowledge through reading.
- *Relatively* resistant to brain injury and dementia.

## Test of Premorbid Functioning

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- Premorbid Prediction Models
  - Demographics only (simple or complex)
  - TOPF only
  - Demographics with TOPF
- Predict WAIS-IV Indexes and WMS-IV IMI, DMI, and VWMI

## Clinical Applications

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Traumatic Brain Injury  
Blake Sample23

## Remember! Many Factors can Influence Performance

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- Acuity
- Attention
- Executive Functioning
- Global Intellectual Functioning
- Working Memory
- Language Impairment (Auditory Memory subtests)
- Visual-Spatial Processing (Visual Memory subtests)
- Fatigue
- Poor Effort
- Impulsivity

## Background Information

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- Blake is a 23 year old, single, white male, with a bachelor's degree in political science.
- He was working as an assistant store manager when he sustained a moderate TBI as a result of a motor vehicle accident.
- Upon admission to the hospital, his Glasgow Coma Scale was 7.

## Background Information

- He sustained hemorrhagic contusions with depressed skull fracture in right frontal area.
- Blood was noted in anterior temporal tip.

## Frontal Lobe



Damage associated primarily with executive dysfunction - possible impaired flexibility in problem-solving or in adaptability (Lezak, et al., 2004).

<http://www.neuroskills.com/tbi/bfrontal.shtml>



## Background Information

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- Blake's orientation and language functions returned to normal after 3-4 hours.
- He experienced on-going headaches, sleepiness, and fatigue for several days.
- He was released from the hospital after 3 days.

## Background Information

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- Blake continued to struggle with fatigue.
- He struggled to concentrate especially when reading.
- He returned to work after 3 weeks but had to leave early because of headaches and difficulty focusing and sustaining his attention.

## Background Information

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- His parents encouraged Blake to seek legal counsel regarding the accident because the accident had been caused by a car whose driver had failed to stop at the red light.
- The lawyer observed that they had a good chance of winning a claim against the company given the on-going difficulties Blake was experiencing after the accident.

## Background Information

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- As part of the legal case, Blake was sent for neuropsychological evaluation of ongoing attention problems.
- The evaluation was conducted 12 months post-injury.

## Traumatic Brain Injury

- Acquired brain injury caused by external physical force
- May lead to temporary or permanent impairment of
  - cognitive,
  - physical, and
  - psychosocial functions.

<http://emedicine.medscape.com/article/326510-overview>

## Moderate TBI - Clinical Concepts

TBI associated with deficits in

- memory
- attention/executive functioning
- processing speed
- theory of mind and social perception (more recently)

## Moderate TBI-Clinical Concepts

- Loss of cognitive functioning from a previous level.
- Impairments in attention and memory.
- Secondary gain introduced by the medical-legal case against the company responsible for the accident.
- Medical evidence for the presence of a moderate TBI.

## TBI and WAIS-IV

Composite	Clinical Mean	Control Mean	Mean Diff.	<i>p</i> value	Effect Size
VCI	92.1	100.8	8.73	.03	.52
PRI	86.1	100.7	14.64	<.01	.94
WMI	85.3	97.9	12.59	<.01	.78
PSI	80.5	97.6	17.09	<.01	.97
FSIQ	83.9	99.4	15.50	<.01	.93

n = 22

## TBI and WMS-IV

n = 32 (ages 19-45)

Index	Clinical Mean	Control Mean	Mean Diff.	<i>p</i> value	Effect Size
AMI	80.0	101.0	21.00	<.01	1.25
VMI	82.5	101.2	18.64	<.01	1.07
VWMI	85.5	104.6	19.06	<.01	1.26
IMI	80.7	102.2	21.53	<.01	1.24
DMI	77.8	100.4	22.64	<.01	1.24
GAI	92.2	104.8	12.65	<.01	.92

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## Procedures Utilized

- WAIS-IV
- WMS-IV
- ACS: Demographically Adjusted Norms
- D-KEFS: Trail Making, Verbal Fluency
- ACS: Social Perception
- ACS: Suboptimal Effort

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## Moderate TBI and Cognition

- Is there evidence of impairment in general cognitive functioning?
- Is there evidence of a deficit in memory?

## WAIS-IV Scores

<i>Index/Subtest</i>	<i>Composite Score/ Scaled Score</i>	<i>Index/Subtest</i>	<i>Composite Score/ Scaled Score</i>
<i>Verbal Comprehension</i>	114	<i>Perceptual Reasoning</i>	98
Similarities	13	Block Design	10
Vocabulary	13	Matrix Reasoning	9
Information	12	Visual Puzzles	10
<i>Working Memory</i>	100	<i>Processing Speed</i>	102
Digit Span	10	Coding	10
Arithmetic	10	Symbol Search	11
Full Scale IQ = 105    General Ability Index = 106			

## Index-Level Discrepancy Comparisons

Comparison	Score 1	Score 2	Difference	Critical Value .05	Significant Difference Y / N	Base Rate Overall Sample
VCI - PRI	114	98	16	9.29	Y	12.2
VCI - WMI	114	100	14	10.18	Y	14.1
VCI - PSI	114	102	12	10.99	Y	22.2
PRI - WMI	98	100	-2	10.99	N	--
PRI - PSI	98	102	-4	11.75	N	--
WMI - PSI	100	102	-2	12.46	N	--
FSIQ - GAI	105	106	-1	3.5	N	--

## Moderate TBI and Ability

- On WAIS-IV, FSIQ and GAI within Average range.
- Verbal comprehension is a strength relative to perceptual reasoning, working memory, and processing speed.

## WMS-IV Scores

<i>Index/Subtest</i>	<i>Index Score/ Scaled Score</i>	<i>Index/Subtest</i>	<i>Index Score/ Scaled Score</i>
<i>Auditory Memory</i>	105	<i>Visual Memory</i>	96
Logical Memory I	13	Visual Reproduction	10
Logical Memory II	16(S)	Visual Reproduction II	10
Verbal Paired Associates I	7(W)	Designs I	8
Verbal Paired Associates II	8(W)	Designs II	10
		<i>Visual Working Memory</i>	100
		Spatial Addition	12
		Symbol Span	8

## WMS-IV Scores

<i>Index/Subtest</i>	<i>Index Score/ Scaled Score</i>	<i>Index/Subtest</i>	<i>Index Score/ Scaled Score</i>
<i>Immediate Memory</i>	96	<i>Delayed Memory</i>	107
Logical Memory I	13	Logical Memory II	16
Verbal Paired Associates I	7	Verbal Paired Associates II	8
Visual Reproduction I	10	Visual Reproduction II	10



## Moderate TBI and Memory

- On WMS-IV, all index scores are in the average range.
- Delayed memory is a strength relative to Immediate Memory (contrast scaled score = 14).
- Scores on memory indexes are average relative to general ability.
- Note relative weakness for VPA I and VPA II and relative strength for LM II.

## Ability-Memory Analysis

Predicted Difference Method: GAI = 106						
Index	Predicted WMS-IV Index Score	Actual WMS-IV Index Score	Diff.	Critical Value	Sign. Diff. Y / N	Base Rate
AMI	103	105	-2	9.35	N	--
VMI	104	96	8	8.95	N	--
VWMI	104	100	4	10.61	N	--
IMI	104	96	8	9.78	N	--
DMI	103	107	-4	9.57	N	--

## Moderate TBI

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- Is this profile atypical for Blake's education level?
- Is there evidence for loss of cognitive functioning.

Use Demographically Adjusted Norms

## Demographically Adjusted Norms

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- Enable clinician to refine hypothesis about the degree to which a specific score is unexpected when compared to individuals of similar background characteristics (e.g., education level).
- Norms approximate the unique demographic subgroup of an individual.

## Demographically Adjusted Norms

Available for WAIS-IV and WMS-IV  
subtest and index scores.

- Education-only adjusted t-scores.
- Full Demographically adjusted t-scores.

## Use of Demographically Adjusted Norms

- Meant to minimize the impact of psychosocial variables on the diagnosis of cognitive impairment, such as estimating the degree of cognitive impairment after a brain injury or insult.
- “. . . most appropriately applied in the context of a neuro-diagnostic assessment.”

## WAIS-IV DAN

**WAIS-IV Education Adjusted Composite Score Summary**

Composite	Age Adjusted		Education Adjusted		
	Composite Score	Percentile Rank	T Score	Percentile Rank	Qualitative Description
VCI	114	82	55	69.1	Above Average
PRI	98	45	44	27.4	Low Average
WMI	100	50	45	30.9	Average
PSI	102	55	48	42.1	Average
FSIQ	105	63	48	42.1	Average
GAI	106	66	49	46.0	Average

## WAIS-IV DAN

**WAIS-IV Demographically-Adjusted Composite Score Comparisons**

Comparison	Score 1	Score 2	Diff.	Critical Value	Sign. Diff.	Directional Base Rate
VCI-PRI	55	44	11	6.20	Y	13.8%
VCI-WMI	55	45	10	6.79	Y	15.4%
GAI-VCI	49	55	-6	3.03	Y	13.5%
GAI-PRI	49	44	5	3.20	Y	18.1%

## WMS-IV DAN

### WMS-IV Education Adjusted Index Score Summary

Index	Age Adjusted		Education Adjusted		
	Index Score	Percentile Rank	T Score	Percentile Rank	Qualitative Description
AMI	105	63	52	57.9	Average
VMI	96	39	45	30.9	Average
VWMI	100	50	47	38.2	Average
IMI	96	39	44	27.4	Low Average
DMI	107	68	52	57.9	Average

## WMS-IV DAN

### WMS-IV Demographically-Adjusted Index Score Comparisons

Comparison	Score 1	Score 2	Diff.	Critical Value	Sign. Diff.	Directional Base Rate
AMI-VMI	52	45	7	5.89	Y	26.3%
VMI-VWMI	45	47	-2	6.20	N	--
IMI-DMI	44	52	-8	6.21	Y	8.3%

## Moderate TBI - Executive Functioning

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### Are there deficits in executive functioning?

- Trail Making: low-average scores for number sequencing and switching.
  - Cannot determine if the problem is executive functioning or slow processing speed.
- Verbal Fluency: scores in the average range.

## Trail Making

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### D-KEFS Trail Making

- Visual Scanning SS = 10
- Number Sequencing SS = 7
- Letter Sequencing SS = 8
- Number-Letter Switching SS = 6
- Number-Letter Switching Errors SS = 10
- Motor Planning SS = 9

## Verbal Fluency

### D-KEFS Verbal Fluency

- Letter Fluency SS = 11
- Category Fluency SS = 9
- Category Switching SS = 8
- Category Switching Accuracy SS = 8
- Set Loss Error SS = 10
- Repetitions SS = 9

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## Moderate TBI - Social Perception

### Is there a deficit in social perception?

- Scores range from low average to average with 3 of 4 scores at 1sd below mean.
- Compared to intellectual functioning, social perception scores were low average.
- Observationally, he made errors mostly on incongruent items, particularly sarcasm.

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## *Social Perception*

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Social Perception has 3 tasks:

- Affect Naming (Happy, Sad, Angry, Surprise, Disgust, Fear, and Neutral)
- Prosody-Face Matching (includes Sarcasm)
- Prosody-Pairs Matching

## Symptom Exaggeration?

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- What if the test results were exaggerated in order to gain an advantage in the law suit?
- Use ACS effort assessment to help determine if suboptimal effort issues should be considered.



## Suboptimal Effort

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### Criteria for definite malingering, neuro-cognitive deficit:

- Presence of substantial external incentive,
- Definitive negative response bias, and
- The response bias is not accounted for by psychiatric, neurological, or developmental factors (Slick, Sherman, and Iverson, 1999).

## Assessing Suboptimal Effort

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- ACS Word Choice
- WAIS-IV Reliable Digit Span
- WMS-IV
  - Logical Memory Delayed Recognition
  - Verbal Paired Associates Delayed Recognition
  - Visual Reproduction Delayed Recognition

[Available for ages 16-69]

## Word Choice

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1. Examinee sees and hears 50 words in succession.
2. Examinee identifies each word as either man-made or natural.
3. Examinee sees card with 50 pairs of words and selects word that was previously presented from each pair.

## Suboptimal Effort

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- Use at least 3 indicators.
- Require at least 2 indicators at or below cut-off when using low cut-offs (e.g. 10%).

See Effort Assessment Score Report Blake Sample 23.

## Blake's Performance

### Effort Score Summary

Score	Raw Score	Overall Clinical Sample Base Rates					
		≤2%	≤5%	≤10%	≤15%	≤25%	>25%
Word Choice	43			X	X	X	
LM II Recognition	27						X
VPA II Recognition	40						X
VR II Recognition	4					X	
<b>Totals</b>		0	0	1	1	2	--

Only 10% of the overall Clinical Sample obtained a raw score of 43 or less on Word Choice.

## Blake's Performance

### Effort Score Analysis

Group of Interest	Percentages With Matching Number of Cut Scores at Cutoff				
	Number of Scores at 10% Cutoff				
	1	2	3	4	5
No Stimulus	100	100	96	60	--
Simulators	64	36	20	10	8
Overall Clinical Sample	19	5	1	0	0
Traumatic Brain Injury	30	6	0	0	0
Nonclinical Sample	7	1	0	0	0
Education Level	4	0	0	0	0
Race/Ethnicity	4	1	0	0	0
GAI	4	0	0	0	0

## Moderate TBI - Conclusions

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- Is this protocol indicative of suboptimal effort? No
- Overall conclusions
  - Blake suffered a moderate/severe TBI as documented by medical records.
  - Relative to his verbal comprehension abilities, he demonstrated a weakness on measures of perceptual reasoning, working memory, and processing speed.

## Moderate TBI - Conclusions

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- Overall conclusions
  - His memory abilities are average compared to his general ability.
  - Interpretation of Blake's performance on the Auditory Memory index should account for the variability of the subtest scores.

## AMI - Score Variability

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The clinical relevance of the score variability on the AMI should be addressed in terms of Blake's

- premorbid abilities,
- demands in his current environment,
- other co-occurring physical factors (e.g., recent onset of auditory acuity difficulties or physical impairments), or
- emotional status (e.g., depression, anxiety).

## Moderate - TBI Conclusions

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Overall conclusions

- He demonstrated weaknesses in switching mental set and social perception.
- These characteristics are consistent with known effects of brain injury.

## Recommendations

- It may be necessary to give Blake very specific routines for work completion. For example, he should be told where to put materials, what to do if he does not understand the assignment, and what to do with the assignment once complete.
- Blake should set well-defined time limits for task completion, so that tasks are completed in a timely manner. Allow him to monitor his own progress with a timing device.

## Recommendations

- Blake should be taught to use a problem-solving approach to behavioral situations.
  - Determine the best possible option for his behavior,
  - Choose a problem-solving strategy, and
  - Evaluate the outcome.
- Concrete examples should be used to teach the approach (e.g., “What should you do if you are trying to concentrate on your work and another person begins talking to you?”).

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Gloria Maccow, Ph.D.

[gloria.maccow@pearson.com](mailto:gloria.maccow@pearson.com)

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