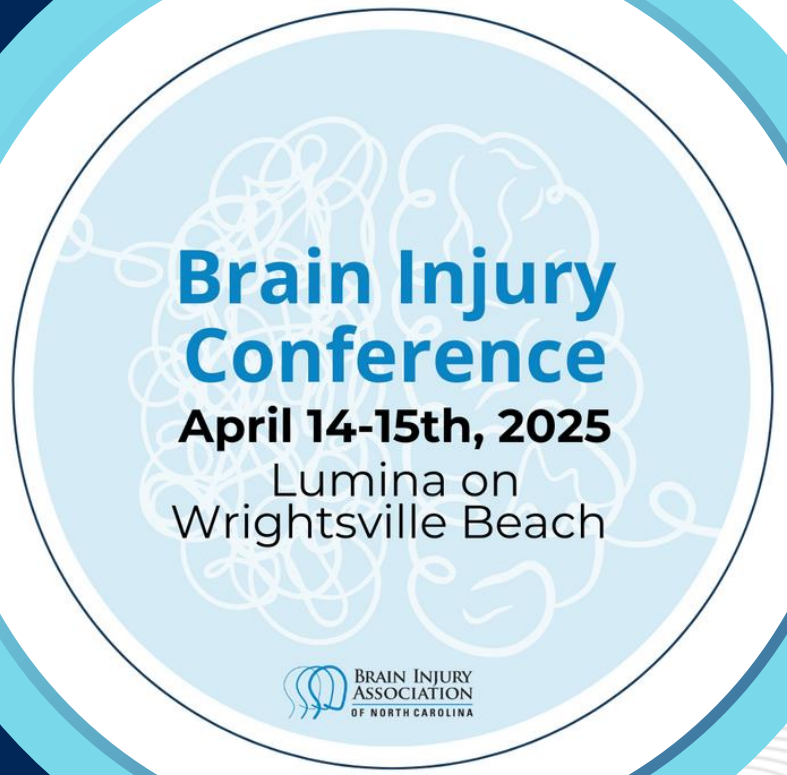
2025 North Carolina Brain Injury Conference



Neuropsychological Assessment of Traumatic Brain Injury

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Brain Injury Association of North Carolina

Neuropsychological Assessment of Traumatic Brain Injury

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Learning Objectives

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1. Provide information about Traumatic Brain Injury from a neuropsychological perspective.
2. Identify evidence-based neuropsychological assessment methods for evaluating cognitive and behavioral sequelae of TBI.
3. Describe cultural considerations and potential biases in TBI assessment.
4. Translate neuropsychological findings into understandable and actionable recommendations to increase functional capacity and community reintegration.

Outline

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- Definition
- Epidemiology
- Type of Brain Injuries
- Neurobehavioral Sequelae
- Neuropsychological Assessment
- Cultural Considerations
- Future Directions

Definition (What)

Definition

- Causes:
  - Forceful bump, blow, or jolt to the head or body, or object entering or affecting the brain.
  - Could be visible or not, physiological or mechanical, often acute but could be slow.

- Outcomes:
  - Temporary or short-term problems (mild)
  - Severe and permanent disability (moderate to severe)and even death

- Examples:
  - How a person thinks, understands, moves, communicates, and acts.

(NIH, 2024)

Classification

- Severity:
  - Mild, Moderate, and Severe
    - Mild is the most common type of TBI. Often recoverable.
    - Moderate and severe may produce permanent disability and may require assistance to adapt.

- Concussion
  - Characterized by temporary, no loss of consciousness, and normal neuroimaging.
  - Often associated with some confusion, and headaches.

Mild TBI

- More significant trauma resulting in more significant changes.
- Examples including confusion, headaches, memory, and changes in personality

(Silverberg et al., 2023)

Traumatic Brain Injury Severity Classification System

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Severity	Glasgow Coma Scale	Loss of Consciousness	Posttraumatic Amnesia
Mild	13-15	< 30 minutes	< 24 hours
Moderate	9-12	30 minutes to 24 hours	1 to 7 days
Severe	3-8	> 24 hours	> 7 days

Note. The American Congress of Rehabilitation Medicine (ACRM) and the Department of Veterans Affairs (VA) have differing views on how to classify individuals with acute intracranial findings seen in neuroimaging. The VA considers these cases to represent at least a moderate traumatic brain injury (TBI), while the ACRM does not include structural findings in its severity classification for TBI (McCrea et al., 2024).

Epidemiology (What)

By the numbers

- Approximately:
  - 214,110 TBI-related hospitalizations in 2020.
  - 69,473 TBI-related deaths in 2021.

- Highest numbers and rates:
  - 75 y/o >
  - 32% hospitalizations and 28% deaths.

- Sex:
  - Males are twice more likely to be hospitalized.
  - Males are three times more likely to die than females.

(CDC, 2024-a)

Epidemiology

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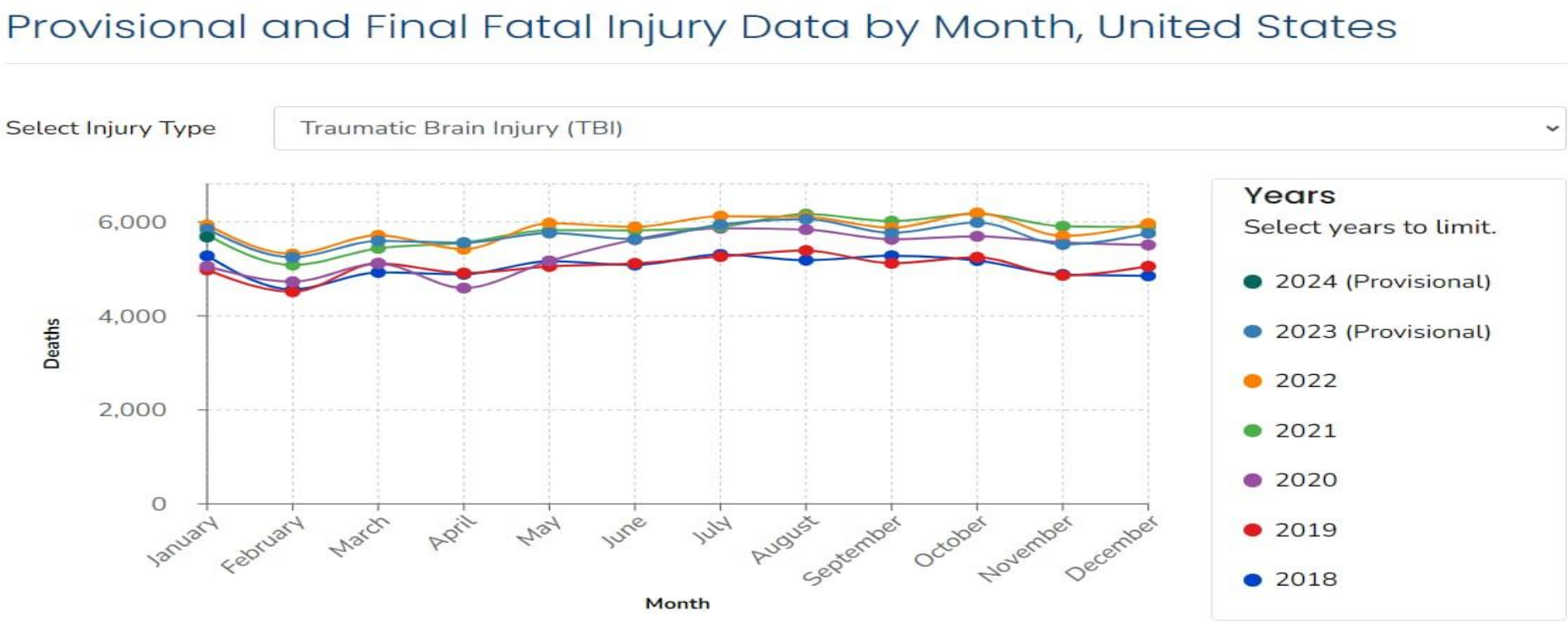

(CDC, 2024-a)

Types of Brain Injuries (What)

Type of Brain Injuries

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- Its effect on neuronal functioning varies with the type of injury:

  - Focal Brain Injury (localized damage; e.g., stroke)
  - Diffuse Brain Injury (widespread damage; e.g., TBI)
  - Secondary Brain Injury (complications; e.g., hypoxia)
  - Concussion/mTBI (metabolic disruption; e.g., sports and MVA)

(McCrea et al., 2024).

Focal Brain Injury

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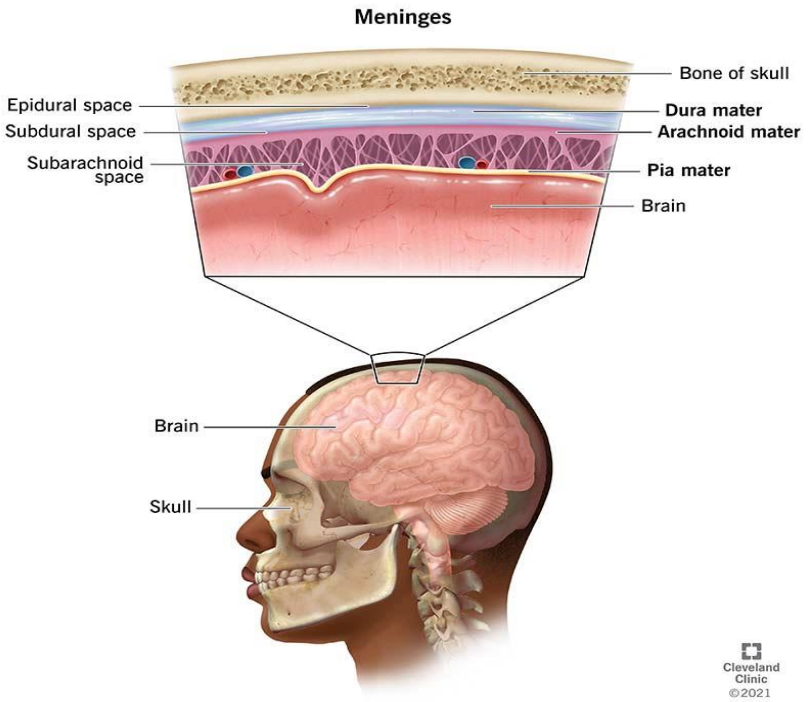
- Common locations:
  - Frontal lobe poles (Executive functioning: planning, organization, decision-making)
  - Temporal lobes (memory)

- Major types:
  - Skull fracture (crack or or opening of skull; infections)
  - Contusions (bruising)
  - Epidural hematoma (EDH) - arterial bleeding, rapid onset
    - Bleeding between the skull and the dura mater.
  - Subdural hematoma (SDH) - venous bleeding, slower onset
    - Bleeding between the dura and the arachnoid mater.



(McCrea et al., 2024)

Diffuse Brain Injury

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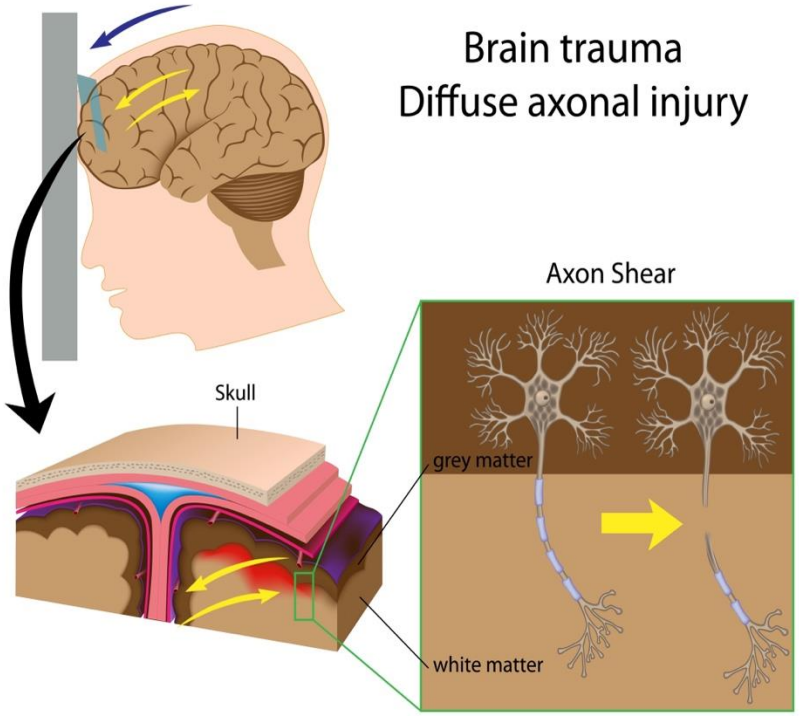
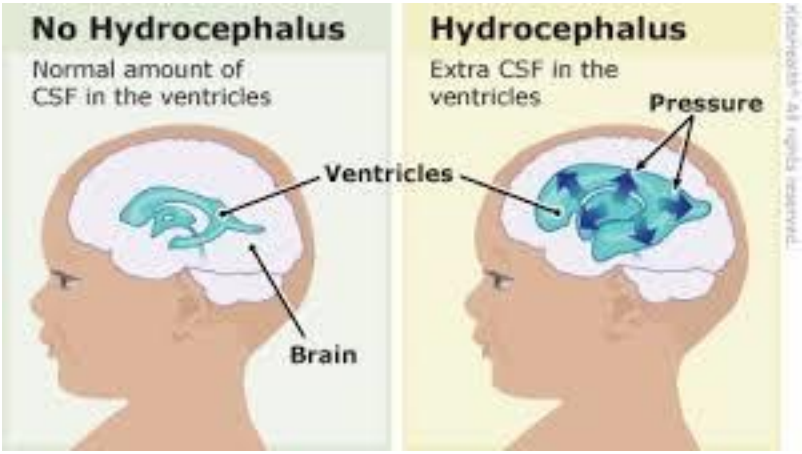
- Traumatic axonal injury (TAI) - temporary disruption
  - Brain deformation stretches nerve fibers
  - Causes temporary disruption of neurapsychological functior
- Diffuse axonal injury (DAI) - permanent damage
  - More severe form with permanent neuropsychological damage
  - Primarily affects white matter tracts
- Primary locations: subcortical white matter, corpus callosum
- Caused by acceleration/deceleration and rotational forces



(McCrea et al., 2024)

Secondary Brain Injury



- Develops hours to days after initial injury
- Key complications:
  - Hypoxia (e.g., smoke exposure)
  - Vascular injury (e.g., strokes)
  - Cerebral swelling (e.g., inflammation)
  - Post-traumatic seizures (from disrupted electrical activity)
- Special risk: Hydrocephalus can develop 1-2 months after subarachnoid hemorrhage

(McCrea et al., 2024)

Concussion Pathophysiology

- "Neurometabolic cascade"
- Features:
  - Ionic shifts
  - Altered metabolism
  - Impaired connectivity
  - Changed neurotransmission
- Recovery timeline:
  - From seconds to permanent; often minutes to hours
  - Physiological disruption is temporary rather than permanent
  - For some, symptoms don’t resolve

(McCrea et al., 2024)

Neurobehavioral Sequelae (What)

Sport Related Concussion Symptoms

Most Common Symptoms

- Headaches (78.5%)
- Fatigue (69.2%)
- Feeling slowed down (66.9%)
- Drowsiness (64.2%)
- Difficulty concentrating (65.8%)
- Feeling mentally foggy (62.3%)
- Dizziness (61.2%)

Least Common Symptoms

- Nervousness (21.2%)
- Feeling more emotional (17.7%)
- Sadness (15.0%)
- Numbness or tingling (14.6%)
- Vomiting (8.8%)

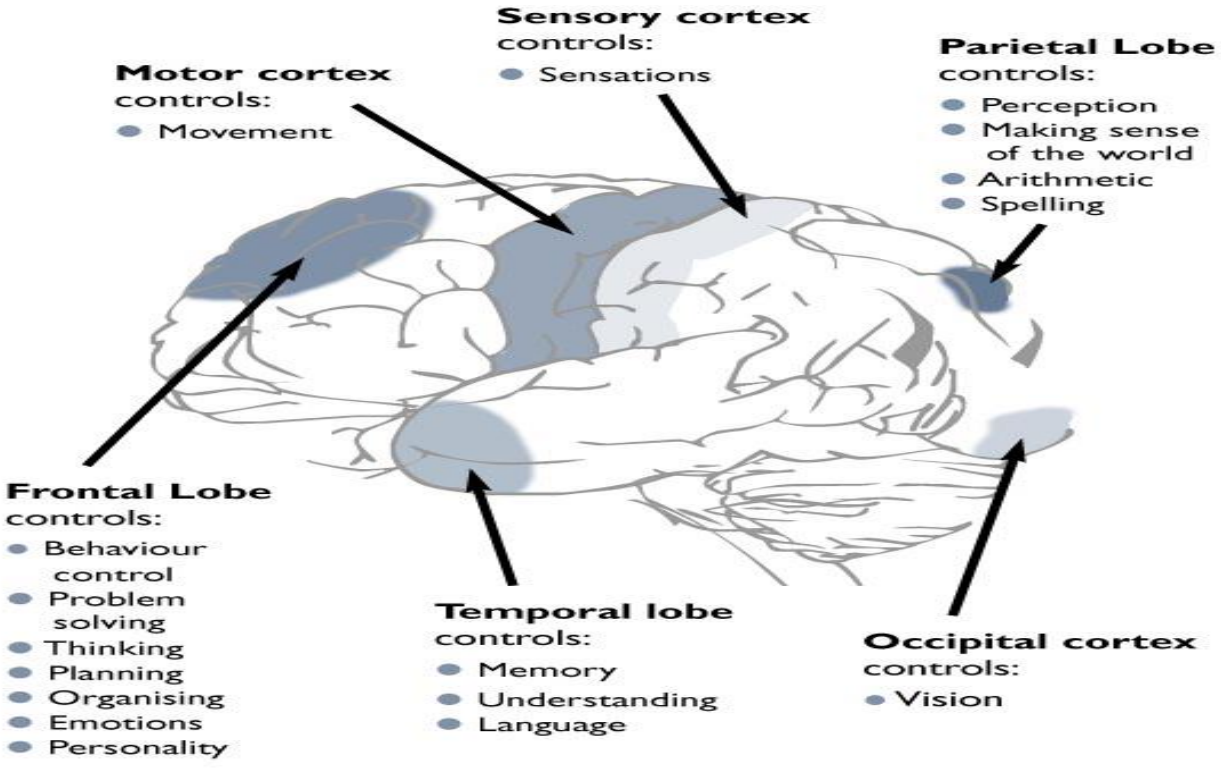
(Lovell et al., 2006)

Post-mTBI Symptoms

- Headache
- Blurred vision
- Dizziness and imbalance
- Concentration problems
- Forgetfulness
- Slowed thinking
- Sleep disturbance
- Irritability

Moderate to Severe TBI: Localization

Depends on localization of the injury.



Moderate to Severe TBI: Symptoms

More typical

Neurocognitive

- Executive dysfunction
- Memory alterations
- Processing speed

Neuroemotional

- Disinhibition
- Personality alterations

Less typical

Sensory

Motor

Seizures

Rapid aging (?)

Neuropsychological Assessment (How)

Defining a Clinical Neuropsychologist

Degrees:

- PhD
- PsyD

Training and Education:

- Bachelors in Psychology
- Masters and Doctorate in Psychology
- Internship
- Postdoctoral Residency
- Continuing Education

Certifications:

- National Register of Health Service Psychologists
- American Board of Clinical Neuropsychology
- American Board of Neuropsychology
- American Board of Pediatric Neuropsychology

Neuropsychological Assessment

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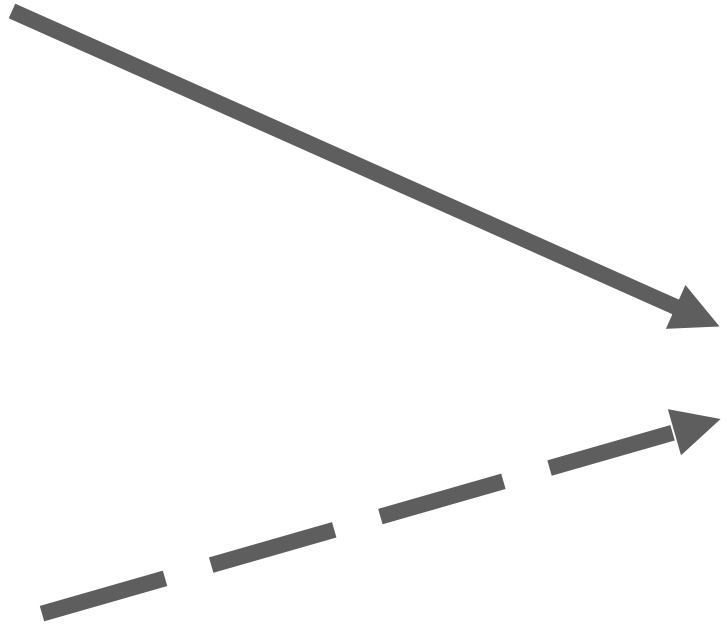
- Record review (critical yet infrequently completed)
- Interview (1-2 hours)
- Comprehensive and standardized assessment (2 or more tests; 1-10 hours)

Typical Questions

- Diagnosis
- Type and level of dysfunction
- Ability to return to gainful employment
- Legal capacity
- Increasing functional capacity
- Interventions

History

- General
  - Biographical- Socio/historical/cultural
  - Familial/Social
  - Educational
  - Vocational
  - Military
- Health
  - Symptom presentation
  - Onset & Course
    - Abrupt vs gradual
      - ❖Correlations
  - Life Effect



Neurobehavioral Status Exam

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Mental Status Examination Plus

- Observations
- Orientation
- Attention
- Communication
- Sensory
- Motor
- Processing Speed
- Fluency
- Learning
- Memory

Neuropsychological Testing

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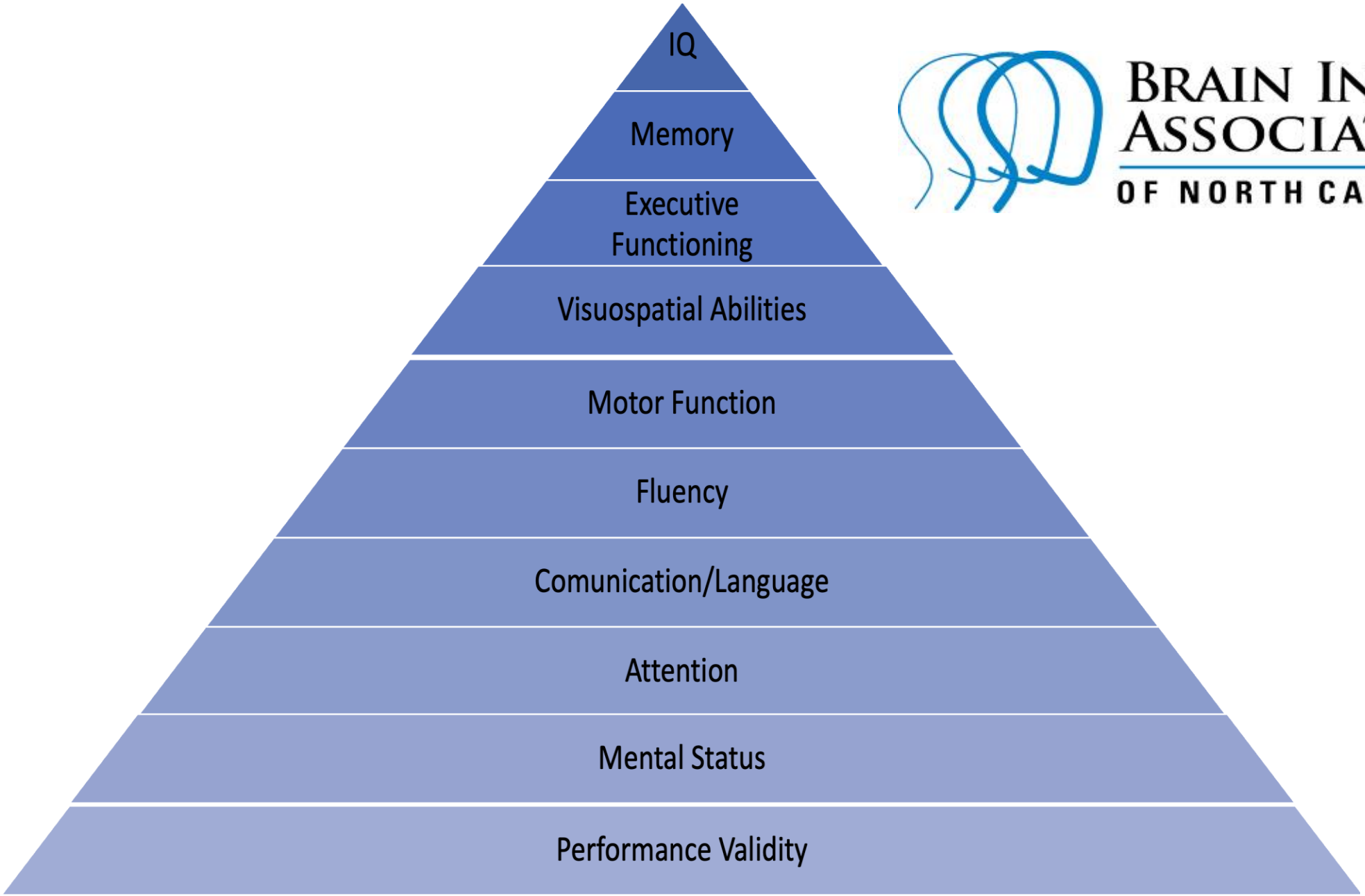
- 1-10 hours
- Standardized
- Scientific
- Comparison to Known Groups
- Often Completed by a Technician



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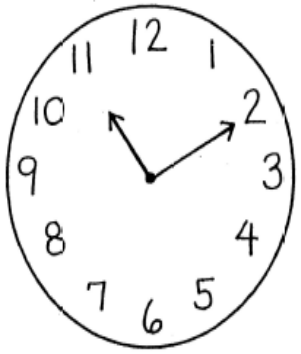
Name _____

Draw a clock and set the hands for 10 minutes past 11

Date _____

Copy this clock below



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Treatment planning & Monitoring

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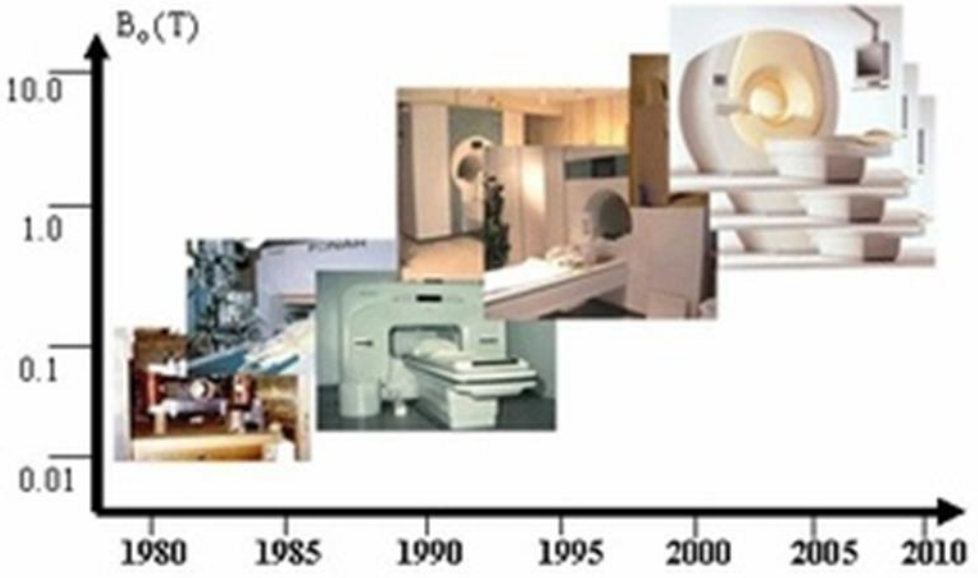
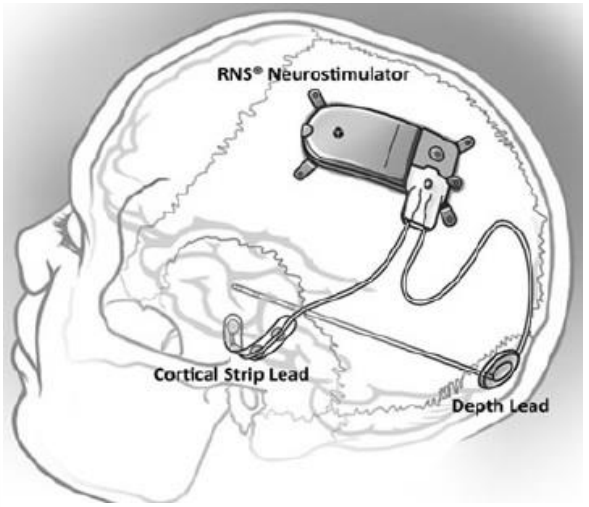
- Interventions
- Activities of daily living
- Legal Implications
- Adaptations
- Modifications
- Follow-up
- Caregiving
- Neurosurgery





Neuropsychological Report

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SECTIONS:

- Identifying Information
- Procedure and Reason for Evaluation
- Record Review
- Interview
- Collateral Interview
- Testing
- Diagnosis
- Actual Elapsed Time
- Recommendations

Cultural Considerations (How)

Bias in Testing

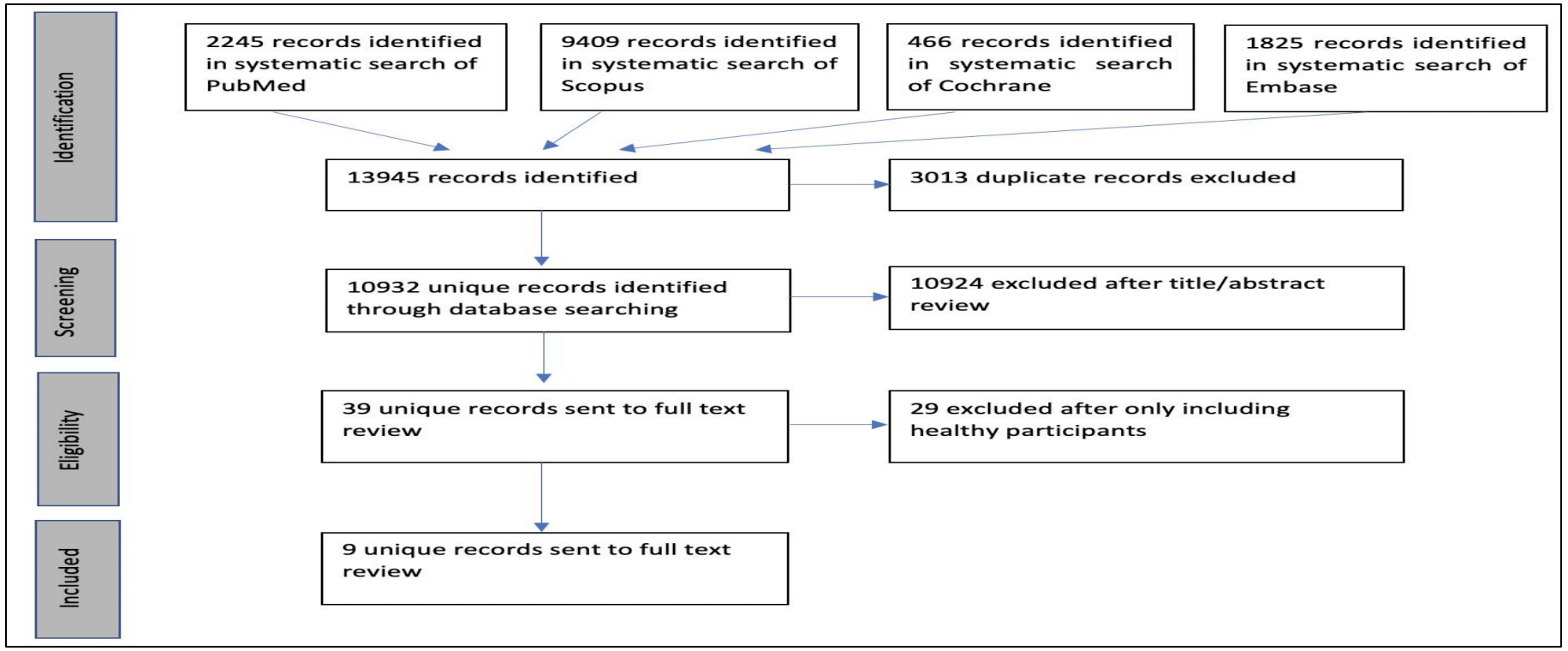
- *Conceptual-*
  - Concept may not apply to other cultures (e.g., time).
- *Constructual-*
  - Construct being measured is not equivalent across groups (e.g., enjoyment).
- *Methodological-*
  - Includes sample bias, instrument bias, and administration bias (e.g., quantitatively focused).
- *Item-*
  - Different groups have different scores on the item (e.g., due to incorrect words or phrases).

Cultural Factors & Racism

- "Colored Children are mentally younger than the white" (Morse & Strong, 1912)
- "Fractionated Man" (Pyle, 1915)
- Black Americans inferior intellectually (Ferguson, 1918)
- Latinos (Pascal & Sullivan (1925)
- *The Measurement of Intelligence* (Terman, 1916)

Cultural Factors in Testing

- Effect of Acculturation on Neuropsychological Test Performance
  - Puente (2023)



Cultural Factors in Testing

- Less acculturated individuals performed worse

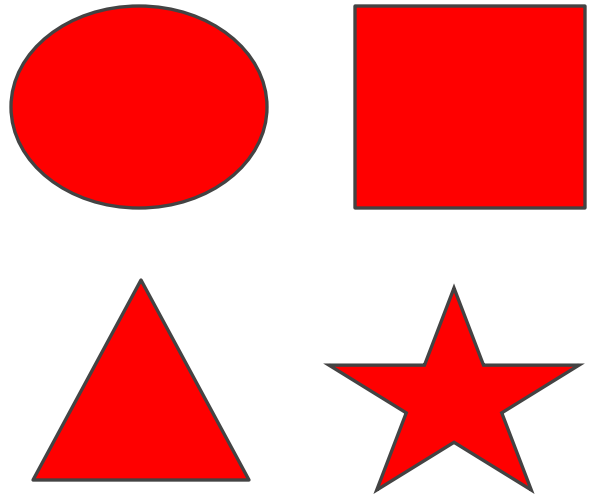
Author	Cognitive Test Domain	Summary of results
Acevedo, 2007	Cognitive Function	Educational attainment was the most influential variable affecting neuropsychological tests, those with less education performed worse on tests of cognitive function.
Razani, 2007	IQ/Intelligence	MEAA group outperformed the ED group on verbal, but not nonverbal subtests.
Razani, 2007	Working Memory, Processing Speed, Attention	MEAA group outperformed the ED group on working memory and attention tests. As level of acculturation increased, as did performance on processing speed, working memory, and attention subtests. The longer one was educated outside the US, the poorer they performed on processing speed and working memory subtests.
Manly, 2004	Achievement	More acculturated African Americans obtained higher scores on achievement measures.
Krch, 2015	Processing Speed, Executive Ability	Hispanics performed significantly worse on processing speed and executive ability tests relative to non-Hispanic whites.
Boone, 2007	Working Memory, Processing Speed, Attention, Language, Verbal Ability, Visual Ability & Memory, Auditory Memory, Executive Ability	Comparison of those who spoke English as native versus as a second language revealed significantly higher performance on tests of memory, language, and verbal fluency.
Kenmotsu, 2013	Language, Attention/Executive Functioning, Initiation and Perseveration, Verbal Memory, Visuospatial Memory, Working Memory	There were no significant differences in the scores between the two groups on the tests administered (Second and Third Japanese American Adults).
Arnold, 1994	Adaptive Motor Learning, Attention, Executive Functioning	A significant effect for acculturation was found on measures adaptive motor learning, with Mexican participants requiring significantly longer completion time than Anglo-Americans.
Strutt, 2012	Cognitive Function	The majority of errors committed by Spanish-speaking HCs on a test of cognitive function were significantly related to level of acculturation; Participants with limited acculturation performed worse on this measure.

Cultural Factors in Testing

- Language
  - Frequency of item
  - Linguistic variations

Cultural Factors in Testing

- Systems
  - Lack fixed boundaries
  - Constantly in flux
  - Interact and compete with one another

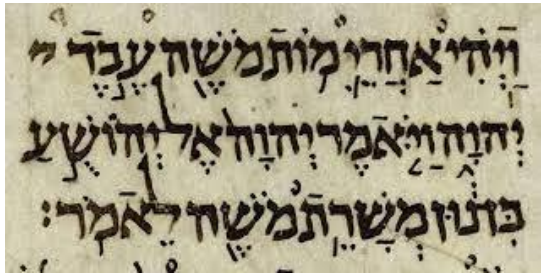


- Symbolic meaning
  - Red
    - Western Countries
      - ❖Danger/Stop
    - Asian Countries
      - ❖Joy

(Gonthier, 2022)

Cultural Factors in Testing

- Visual Exploration
  - Left to right vs right to left
    - Hebrew
    - Arabic



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(Gonthier, 2022)

Cultural Factors in Testing

- Value of time & testing familiarity
- US society and educational system
  - Testing through development
  - Quick and accurate
    - Timed tests
    - Deadlines
    - Time = efficiency & intelligence

Attitudes Towards Time

Table 2. Neuropsychological test results (raw scores) for the American (USA) and Russian groups

	Range		Mean		*SD*			
Test	USA	Russia	USA	Russia	USA	Russia	*p*	Cohen's *d*
CTT1	18–47	16–71	27.78	35.30	6.93	11.57	<.001	.79
CTT2	36–88	40–109	54.30	64.94	11.67	16.89	<.001	.73
RFFT	71–146	50–128	105.46	99.26	16.40	17.73	.089	.34
ToL^{Dx}	9–104	22–209	49.26	66.98	24.43	39.30	.008	.55
SDMT	46–80	33–84	62.76	58.12	8.89	11.12	.023	.47

Note. CTT1 = Color Trails Test, Part 1, Completion Time, sec; CTT2 = Color Trails Test, Part 2, Completion Time, sec; RFFT = Ruff Figural Fluency Test, Number of Unique Designs; ToL^{Dx} = Tower of London, Drexel Edition, Initiation Time, sec; SDMT = Symbol Digit Modalities Test, Total Score. Cohen's d value below l.20l is considered small effect size, l.50l is medium, and above l.80l is large.

(Agranovich et al., 2011)

Fairness in Testing

"Accessible testing situations are those that enable all test takers in the intended population, to the extent feasible, to show their status on the target construct(s) without being unduly advantaged or disadvantaged by individual characteristics (e.g., characteristics related to age, disability, race/ethnicity, gender, or language) that are irrelevant to the construct(s) the test is intended to measure." (AERA, et al., 2014, p.52).

Test Selection

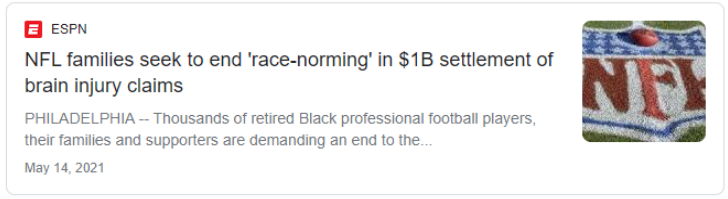
"Validity and reliability/precision considerations are paramount, but the demographic characteristics of the group(s) for which the test originally was constructed and for which initial and subsequent normative data are available also are important." (AERA et al., 2014, p. 152)

Standard 10.5:

- Tests selected for use in psychological testing should be suitable for the test taker's characteristics and background (AERA et al., 2014, p. 165).

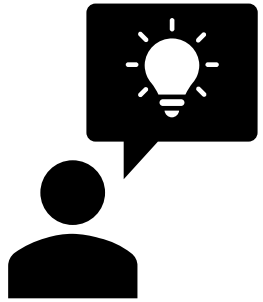
Based Race Norms

- Race is the fourth major demographic variable to consider when stratifying neuropsychological test norms after age, education level, and gender.
- It theoretically reduces the number of false positives or false negatives.
- Examples: National Football Leagues and Racial Justice Act



Ways to Reduce Bias

- Scientific and clinical knowledge accompanied by cultural humility.
- Norms
  - Demographic calibration versus calibration by age alone.
    - Accurate and meaningful test scores
- Adaptation vs. Modifications of current neuropsychological tests.
- Development of completely new neuropsychological tests, ecologically valid and technologically encrusted.



Future Directions

Minnesota Conference: Assessment

Conduct culturally-informed neuropsychological evaluations. Use tests and procedures, including measures developed with innovative methods and technologies, that are evidence-based, reliable, valid, and culturally and normatively appropriate. Develop diagnostic case conceptualizations and interpretations that consider ethnicity, language, education level and quality, literacy, gender, sexual orientation, disability status, and other identities and their intersectionality. Utilize tests and procedures, including measures developed with innovative methods and technologies, that are evidence-based, reliable, valid, and culturally and normatively appropriate.

Neuro/Psychological Methodology

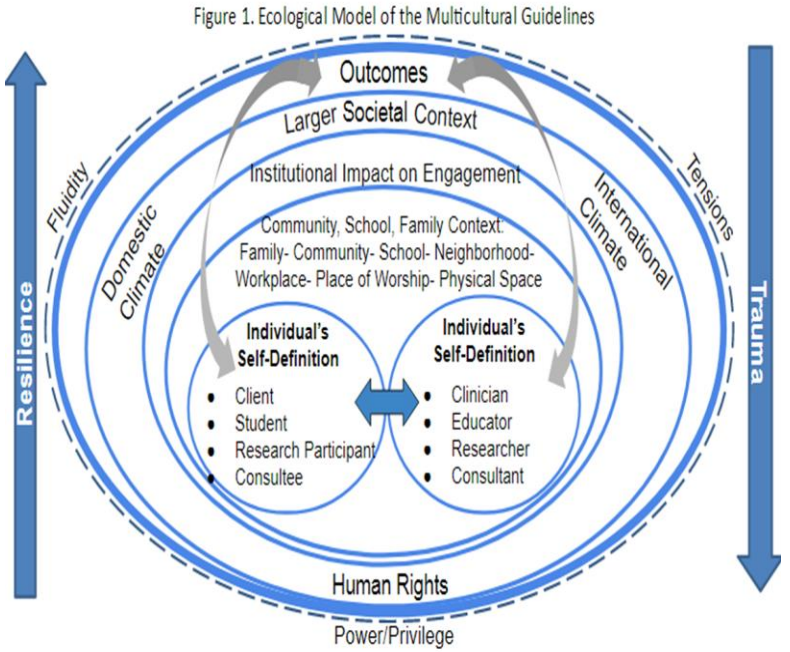
- Sperry
  - Left hemisphere/Right hemisphere
  - Western: Quantitative

Neuro/Psychological Methodology

- Sperry
  - Left hemisphere/Right hemisphere
  - Western: Quantitative
- Luria & Vygotsky
  - Socio-historical-cultural context
  - Eastern; Qualitative

Neuropsychological Methodology

- Sperry
  - Left hemisphere/Right hemisphere
  - Down/Up; Up/Down
  - Western: Quantitative
- Luria & Vygotsky
  - Socio-historical-cultural context
  - Hierarchical
  - Eastern; Qualitative
- Hybrid
  - Right/Left; Socio-Historical Cultural Context
  - Integrative of Quantitative & Qualitative; Global
  - "Scientifically romantic"



APA 125
AMERICAN PSYCHOLOGICAL ASSOCIATION

The Old Man and the Sea

Ernest Hemingway

Cojimar, Cuba

Information

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- **Resources:** Available book chapters & articles: www.antonioepuente.com

Resources

American Psychological Association

- Ethical Standards for Psychologists
- Standards for Educational and Psychological Tests & Assessments
- Guidelines on Multicultural Education, Training, Research, Practice, and Organizational Change for Psychologists

National Academy of Neuropsychology

Society for Clinical Psychology

Hispanic Neuropsychological Society

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