How neuropsychology can inform rehabilitation after a brain injury

By: Sylvain Roy, Ph.D., C. Psych.
Clinical neuropsychologist

CHIRS Community Head Injury Resource Services

Inner City FAMILY HEALTH TEAM

The Neuropsychological assessment

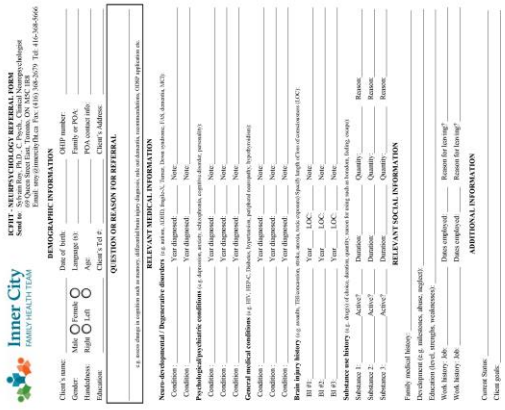
- **Purpose: Diagnosis, inform treatment**
- **Testing: 4 to 8 hours (or more)**
- **Domains of study:**
  - Orientation
  - Mental status
  - Learning/memory
  - Intelligence
  - Language
  - Visuo-perception
  - Executive functions
  - Sensory-motor
  - Processing speed
  - Emotion

- Profile of strengths and weaknesses can inform rehabilitation

Functional questions

- Diagnostic questions:
  - Does the person have a brain injury
  - Does the person have dementia
- Functional questions:
  - Can the person live independently (safety issues)
  - Can the person complete basic ADL
- Prognosis:
  - Will the person's cognition improve of deteriorate
  - Can the person return to work (e.g. crane operator/hemi-neglect)
  - Will the person manage their finances (e.g. math & money)
- Intervention:
  - Can the person's behaviour be altered (e.g. aggression).
  - What are some treatment options (e.g. cognitive compensation)

3



ICHT - NEUROPSYCHOLOGY REFERRAL FORM

Inner City FAMILY HEALTH TEAM

DEMOGRAPHIC INFORMATION

QUESTION OR REASON FOR REFERRAL

RELEVANT MEDICAL INFORMATION

RELEVANT SOCIAL INFORMATION

ADDITIONAL INFORMATION

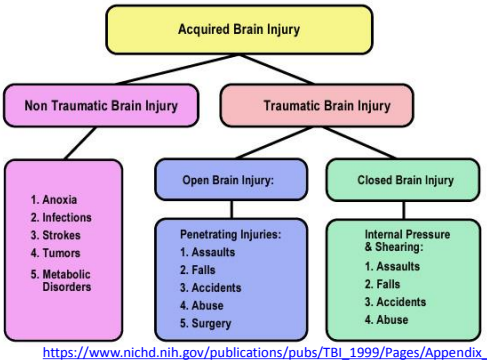
Neuropsychology in everyday life

- "Navigating through daily life is a complex and dynamic process. We must constantly filter new information, prioritize actions, attend to problems, engage in risky activities, track appointments, and deadlines, interact with others, and change strategies as needed"
  - Life is a neuropsychological test. Robert K. Heaton
- There is not a 100% correspondence with cognitive abilities (in a clinic) and functional capacity (in the wild)
  - After ABI, the person may learn to compensate for an impairment (e.g. smartphone for memory impairment)
  - Testing in a clinic is quiet and organized

Benefits of a neuropsychological assessment

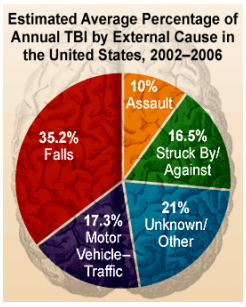
- Someone with a memory impairment may have difficulty with a task that loads heavily on memory such as taking medications, but may do well on others loading on procedural tasks such as dialling a phone number.
- Paying bills may be difficult after ABI because of an inability to understand the bill (unable to do the math, too many details), or has forgotten that the bill arrived. He may also be confused about how to use a check, prepare a envelope for mailing, failing to check balance online etc.
- An assessment can help predict/prevent problems with ADLs by examining how cognitive impairments or person-specific variables influence or interact with task-specific factors (task analysis)

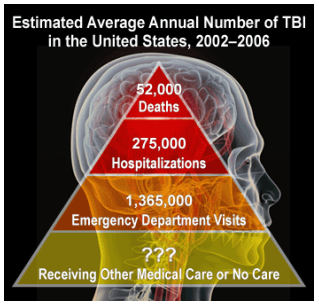
The fragility of the human brain



https://www.nichd.nih.gov/publications/pubs/TBI_1999/Pages/Appendix_A.aspx

The fragility of the human brain

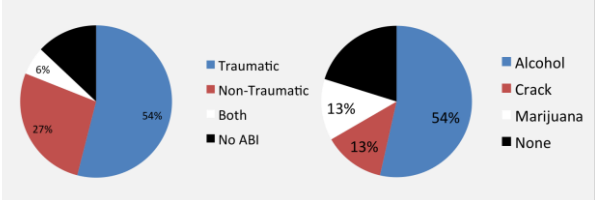




http://www.cdc.gov/Features/dsTBI_Brainiñjury/

Inner City Family Health Team

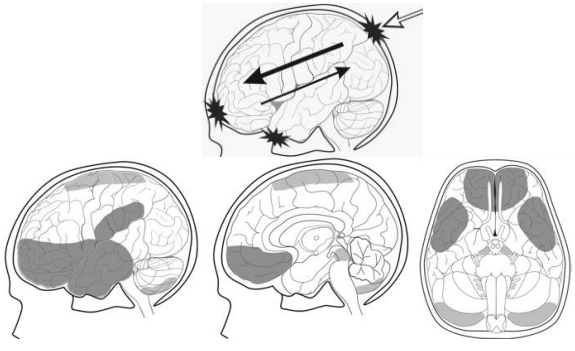
- N=15 (referred to neuropsychology)
- Mean age: 54.9 (SD 14.4)
- Mean Schooling: 10.3 (SD 3.0)
- Housing situation : 66.6% (homeless)

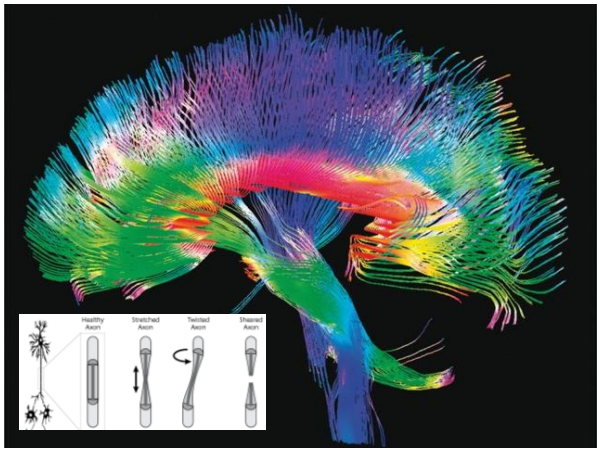


The fragility of the human brain

The fragility of the human brain

The fragility of the human brain





Measuring severity of TBI

Classification	Duration of unconsciousness	Glasgow coma scale	Post-traumatic amnesia
Mild	<30 minutes	13–15[b]	<24 hours
Moderate	30 minutes–24 hours	9–12	1–7 days
Severe	>24 hours	3–8	>7 days

Feature	Scale Responses	Score Notation
Eye opening	Spontaneous To speech To pain None	4 3 2 1
Verbal response	Orientated Confused conversation Words (inappropriate) Sounds (incomprehensible) None	5 4 3 2 1
Best motor response	Obey commands Localise pain Flexion – Normal – Abnormal Extend None	6 5 4 3 2 1
TOTAL COMA 'SCORE'		3/15 – 15/15

14

The fragility of the human brain

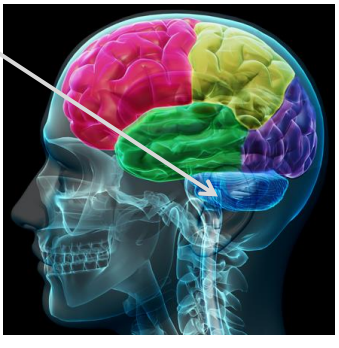
Functional neuroanatomy

Parietal Lobes
- Sense of touch
- Spatial perception
- Visual attention
- Integration of senses

Occipital Lobes
- Vision
- Perception

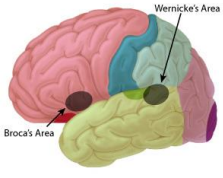
Functional neuroanatomy

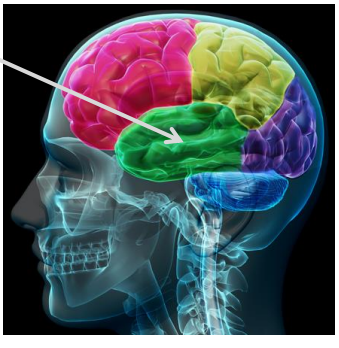
Cerebellum and deep structures
- Brainstem:
- Breathing, heart rate, blood pressure, Consciousness, Sleep/wake cycle, Temperature regulation



Functional neuroanatomy

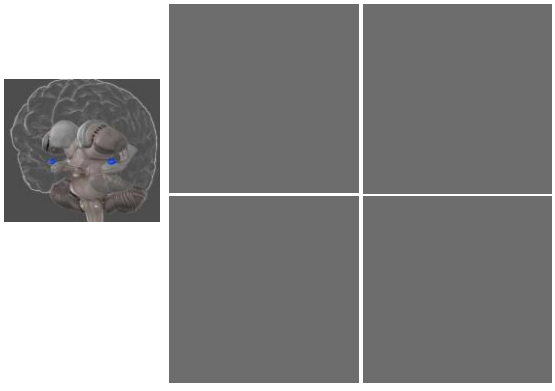
Temporal Lobes
- Learning and memory
- language
- Emotions
- Hearing

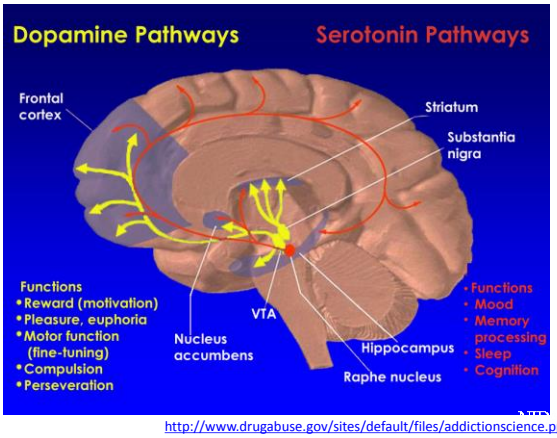




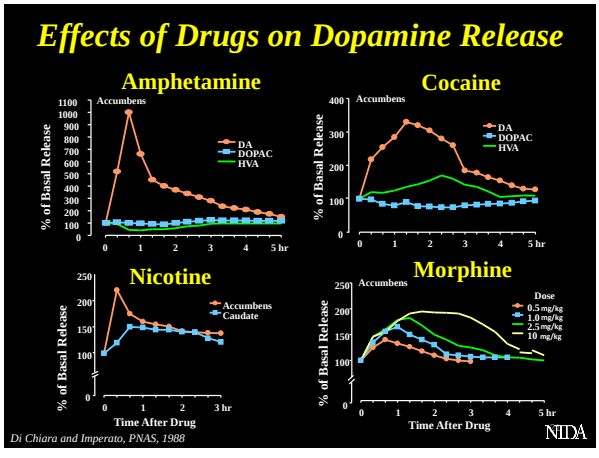
Functional neuroanatomy

Amygdala: Can you recognize these emotions?





http://www.drugabuse.gov/sites/default/files/addictionscience.ppt



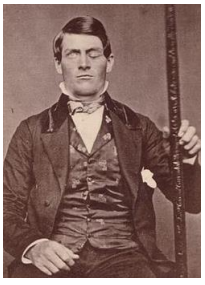
Functional neuroanatomy

Frontal Lobes

Initiating, planning, organizing
Awareness/self-monitoring
Attention, memory recall
Judgement, impulse control
Social behaviour, personality
Emotion regulation
Speaking / Moving

Functional neuroanatomy

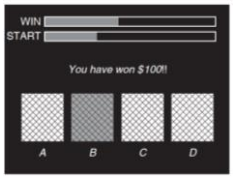
Phineas Gage: Profound personality changes following a frontal lobe injury caused by an explosion that sent a metal rod through his skull.



Decision Making

- Processes that govern choice behaviour when the confronted with situations that have multiple response options.
- Damage to the ventromedial/orbitofrontal cortex may lead to impulsivity, socially inappropriate behaviour and poor judgement.
- They people may make decisions (financial, occupational, interpersonal) without considering/or caring about the long-term ramifications.

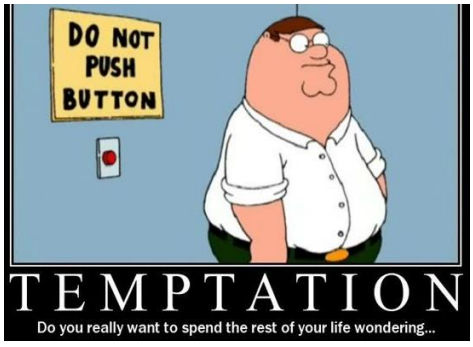
The somatic marker hypothesis



- OFC patients driven by the short term benefits associated with the risky decks, rather than the long term punishments
- May exercise poor judgment /decisions because he fails to integrate emotional learning (gut feeling) and balance the short term benefits with long term negative consequence.

Bechara & Damasio (1994)

Self regulation



How can you be aware that you're not aware, when you're not aware you're not aware? Dr. Guy Proulx

*Denial or Anosognosia (*A lack of knowledge or unawareness of cognitive impairment)?

Up to 45% of persons who sustain moderate to severe TBIs are reported to have reduced awareness of physical, and/or cognitive deficits (Flashman and McAllister 2002).

This tends to be function specific, in which some deficits may be accurately assessed by the patient (e.g., hemiplegia), while other less so (e.g., cognitive skills).

Client may underestimate the severity of cognitive or behavioural impairments when compared to family ratings.

Can result in poor treatment compliance, reduced functional independence and employability.

Metacognition

Knowing what you know:
Needed to change behaviour & evaluate strategies needed for change.

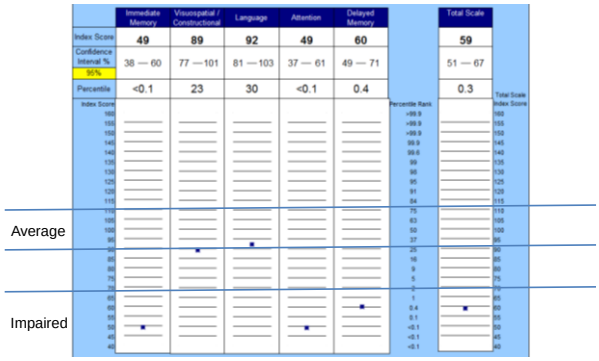
"And then it hit me: I'm salivating over a goddam bell."

Case illustration

- Older male
- Cardiac arrest on 2007 & moderate anoxic encephalopathy.
- History of hypertension and peripheral vascular disease
- Heavy smoker for 53 years (up to two packs of cigarettes a day).
- Moderate marijuana use (for sleep, anxiety)
- Was a successfully employed prior to ABI

- Initially confabulatory & confused, but has made a gradual recovery.
- Later unable to return to work
- Developed severe depression

Later, as impairments became more apparent he became angry at paramedics for reviving him.



Treatment outcome (2011 – 2013)

- Counselling (1.5 years – 30min 1x week) – passive suicide ideation
- Neuropsychological testing - 2012
- CHIRS case management (4 hours x week)
  - Court diversion support
- Loft/Crosslinks Housing/Case management
- SUBI initiative
  - ✧ Behavioural therapy
  - ✧ Substance use counselling
  - ✧ Cognitive compensation strategies & Motivation board
  - ✧ Anger management group (adapted for cognitive impairments)
- CHIRS mentorship program
- Medical management (neuropsychiatrist)

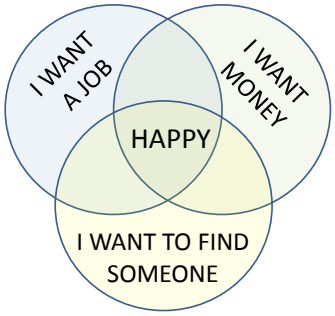
"I'm going fishing this weekend"
"I'm saving 5$ a week so I can go to CUBA and smoke a Cuban cigar with my daughter"

Why won't my patient follow through *CHIRS & ICFHT data*

- Processing speed (white matter lesion)
- Learning & Memory (recall vs. recognition)
- Attention & Concentration (sustained, divided)

- Initiation (getting out of bed, starting task)
- Impulse control/distractibility (reduce distraction)
- Cognitive flexibility/rigidity (1 step at at time – not 5)
- Self-awareness (gentle confrontation e.g. video, groups)

On happiness: If you had three wishes...



Are these reasonable client goals?

What is Positive Psychology?

Seeks to create PERMA in your daily life

Positive Emotions, Engagement, Relationships, Meaning, Accomplishments