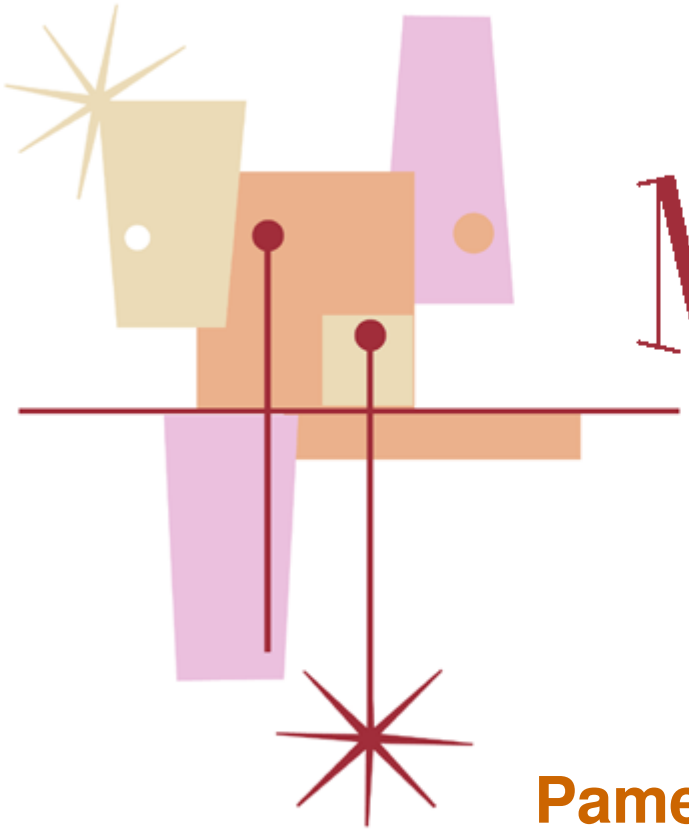

Attention, Memory, and TBI

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To begin…

Traumatic Brain Injury (TBI) is becoming a common occurrence, with nearly 400,000 new injuries per year.

TBI is known to affect cognitive functioning including attention.

The majority of persons who suffer even minor head injuries have difficulty with attention, concentration, memory and judgment.

Attention is critical to all areas of cognitive functioning, including language.

- Recent distinction between declarative and nondeclarative kinds of memory arose from research to find what kind(s) of memory is lost and what is spared after certain types of brain damage.

- Patients who report a greater number of symptoms at 1, 6 or 12 months after suffering from mild head injury may have more attentional deficits than patients reporting few or no symptoms.

- It also appears that there are large variations within these patients in terms of both presented symptoms and neuropsychological performance.

- The impact of head injuries on cognitive and neuropsychological functioning can be extensive and wide-ranging.

- Attention and Memory deficits are some of the most striking cognitive difficulties commonly reported by patients and their relatives following head injuries.

- 50% of patients suffering from mild to moderate closed head injuries will develop a group of clinical symptoms known as post-concussion symptoms (PCS). Characterized by a range of subjectively experienced symptoms including:
  - headaches
  - dizziness
  - fatigue
  - irritability
  - slowed thinking
  - memory dysfunction

What is Memory?

- Memory is not a single entity, but instead consists of several functions supported by independent brain regions.
- Memory Systems: specific neural networks that support specific mnemonic processes.

Where Memory Resides

- Declarative memory is generally thought to reflect an interaction between medial-temporal/ diencephalic and neocortical brain regions.
- Medial-temporal or diencephalic lesions spare remote memories, which encourages the view that the neocortex is the ultimate repository of consolidated long-term memory.
- Neocortex contributes to the encoding, storage and retrieval of declarative memories.

Types of Memory

- **Declarative Memory**
  - Examples: memory for events (episodic) or facts (semantic memory)
- **Nondeclarative (Procedural) Memory:** encompasses the acquisition, retention, and retrieval of knowledge expressed through experience-induced changes in performance.

Types of Memory, Con’td

- **Episodic Memory**: measured by direct or explicit test of memory, such as free recall, cued recall, or recognition, that refer to a prior episode.
- **Working (short-term) Memory**: ability to keep a limited amount of information “on line” for immediate use during short intervals.

Seven Sins of Memory

- **Transience**: forgetting information over time.
- **Absent-mindedness**: lapses in attention that produce forgetting.
- **Blocking**: temporary inability to retrieve information.
- **Misattribution**: confusing the source of a memory.
- **Suggestibility**: incorporating misleading information into memory.
- **Bias**: influence of present knowledge and beliefs on recollections of the past.
- **Persistance**: unwanted memories

Cognitive Neuroscience

- Based on observations of brain damaged patients with various kinds of memory loss, & brain imaging techniques
- The fractionation of memory into component systems and subsystems has been a major theme in the cognitive neuroscience of memory for the past 10-15 years
- Brain imaging techniques are now providing new perspectives on various forms of memory

Neurocognitive Networks

- Recent advances in basic and cognitive neurosciences now allow a more detailed analysis of networks.
- Memory and Learning can be divided into several behavioral components: registration storage (encoding), retention and retrieval.
- Memory can also be classified according to modality (visual and auditory) or material (verbal and nonverbal) that is being processed.

Localization of Memory

- Nyberg & Tulving review suggest the two declarative systems (episodic and semantic) seem to depend on integrity of medial temporal lobe structures.
- Frontal lobe structures have been found to be critical for both episodic and semantic memory, but different frontal regions seem to be important for the 2 systems.
- Frontal regions in the left hemisphere are more involved with semantic memory, while the frontal regions in the right hemisphere are more involved with episodic memory. (PET studies suggest cerebellum plays an important role in these 2 systems).
- Occipital brain structures are critical for visual subsystem of perceptual representation.
- Midbrain structures in procedural memory have been confirmed by several PET studies.

Source: Nyberg and Tulving, (1996), "Classifying Human Long-Term Memory: Evidence from Converging Dissociations", European Journal of Cognitive Psychology, 8(2), 163-183.

The Future of Memory

- Research plays an important role in shaping our ideas about classifying memories.
- Evidence supports memory localization and systems, which leads the way to studying recovery and plasticity of the brain.
- If memory systems are in fact located in more than one place in the brain and are more of a network, why can't brain plasticity aid in recovery of functions?
- Further research is needed and encouraged and positive hypotheses need to be agreed upon.

Attention…

- a vague and often used word in describing human behavior, which may be quantified by intensity and qualified by selectivity. This is how a person consciously makes an effort at one task, and how he can selectively withdraw from it, in order to deal effectively with the second task.

Voluntary Attention

Voluntary Attention can be directed to past or future events.

*Selected
*Sustained
*Divided

Selected Attention…

- attends to one of the concurrent streams of input such as voice of a certain speaker, either in a crowd or alone in order to get the message.
- attends to voice of speaker but listen to it as an acoustic phenomenon, without caring about the message.
- could have a broad or narrow focus.

Divided Attention…

- when subject simultaneously monitors two or more input sources such as listening to separate dichotically presented stories.
- capacity limitation occurs when performance decrement in one task takes place due to performing the other task. The performance in the second task is often used as a measure of spare capacity left over by the primary task in which the performance may remain at a steady level, due to “resource allocation”.

Sustained Attention…

interest is in long-term performance decrement, mainly in detecting infrequent and unpredictable weak signals.

Involuntary Attention

- only operates in present time.
- Types:
  - Passive
  - Distraction

Passive Attention…

- when events attract our attention away from the task we are performing, such as, a loud noise.
- orienting reflex or response is elicited, which is an overt body change.
- to investigate sound (was once called investigatory reaction by Ivan Pavlov).

Distraction…

- when we try to concentrate on some demanding mental task, and occasional sounds and other irrelevant stimuli are regarded as distraction.
- increased effort is usually needed to complete task and ignore stimuli.

Attention Theories

- Dual process theory of attention
  - Automatic processing
  - Controlled processing

- Resources allocation theory of attention

Dual Process Theory: Automatic Processing…

- a fast, parallel, and effortless process that is not limited by short term memory capacity.
- not dependent on conscious choice.
- not impaired by the concurrent execution of another task.
- responsible for well developed skilled behavior.

Dual Process Theory: Controlled Processing…

- slow, generally serial, and effortful process that is limited by capacity.
- responsible for the self-regulated processing that must be dealt with for the novel or inconsistent information.

Attentional Problems: 2 types

- Focused attention deficits
- Divided attention

Focused Attentional Deficits…

- occur when a response produced by automatic processing interferes with a response produced by controlled processing.

Divided Attentional Deficits…

- result from the limited capacity of the system for controlled processing.
- not enough “resource allocation”.

Resource Allocation Theory…

- noted as a power supply that can be flexibly allocated in many different ways in response to task demands.

Other types of Attention: Past & Future Directed…..

- Past Attention: attend to a sound that occurred 2 seconds ago by attending to its representation in echoic memory.

- Future Directed Attention: concentrating on responding as fast as possible to a visual signal to be delivered in the immediate future (simple reaction time) or to a certain one of three visual stimuli delivered in random order (go/no-go or choice reaction time); this form of attention could be called expectant or anticipatory.

Motor Domain

- A difficult motor performance needs strong concentration in order to succeed.
- Such performances are based on motor programs stored in the CNS, and their adequate selection and release often require total involvement of the mind in its performance.
- Ballistic movements: performance is so short that once started no chance of correcting.

Thinking…

- has a definite goal or directed thinking or another term Mental work.
- ability to maintain the mental focus and to shift according to change in mental environment.
- Goal directed thinking is another form of directed central activity.

Automaticity

- There are three criteria for a process to be purely automatic:
  - occurs without intention, involuntary
  - occurs without giving rise to any conscious awareness
  - occurs without producing interference with other ongoing mental activity

Common Deficits found in TBI

- TBI can display a variety of memory impairments such as:
  - forgetting new information
  - Impaired prospective memory
  - Interference
- TBI also display executive function impairments such as:
  - Impaired self-monitoring
  - Strategy decision making
  - Planning
- Retrieval deficits
- Acquisition of new information
- Working memory impairment; which is critical in the encoding of new information
- Impaired episodic memory
- TBI can display attention deficits such as:
  - Attention allocation
  - Decreased focused attention
  - Decreased divided attention

Memory and Attention deficits go hand in hand. These two functions depend on each other for success.

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