

Brain Injuries And "Emotions"

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What we know...

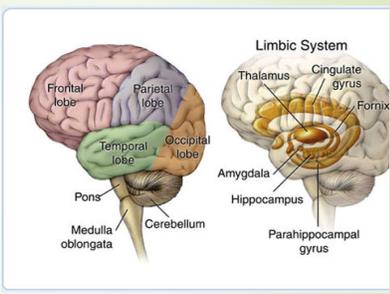
- Neurotransmitter deficit after brain injury
- Mental health issues before brain injury usually get worse afterwards
- Emotions may change due to brain trauma – emotional lability, flat, etc



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Anatomy

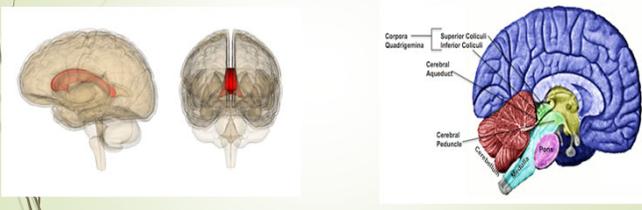
- Limbic system
 - Amygdala
 - Thalamus
 - (Hypothalamus)
 - Hippocampus
 - Cingulate gyrus
 - Fornix
 - Parahippocampal gyrus



<https://www.brightfocus.org/dementia/blog/2016/07/brain-anatomy-and-limbic-system>

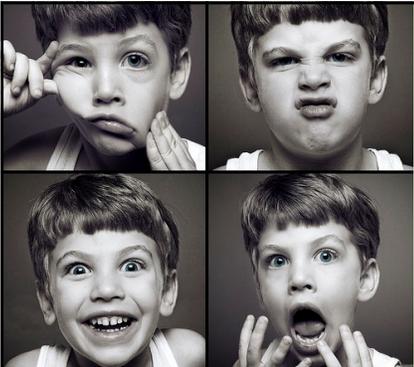
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What structures are injured in concussion?



The image contains three diagrams. On the left, two sagittal views of the brain show red areas indicating injury in the frontal and posterior regions. On the right, a detailed cross-section of the brain is labeled with the following structures: Superior Colliculus, Inferior Colliculus, Corpora Quadrigemina, Cerebral Aneurysm, Cerebral Peduncle, and Pons.

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What else can look like emotional issues?

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Central Processing dysfunctions after neurologic insult

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Newer concept in brain dysfunction

- ▀ Visual processing
- ▀ Auditory processing
- ▀ Vestibular processing
- ▀ Sensation (touch) processing
- ▀ Spatial processing
- ▀ Others....

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Vision is a **BIG** Deal!



- ❖ Vision is **NOT** just 20/20 eye sight, it is an **intricate brain process!**
- ❖ 70% of the brain is dedicated to vision and visual processing.
- ❖ Vision involves the coordination of over 20 visual abilities & 2/3 of brain pathways.
- ❖ 80% of the information we process is directly affected by information coming in from the eyes.
- ❖ **Nearly impossible to NOT have vision issues after an injury or insult to the brain!**

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- 2 dimensional world
weirdly detailed, infinite scope

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Definition of vision
A dynamic interactive process of
motor and sensory function
mediated by the eyes for the purpose of
simultaneous organization
of
posture, movement, spatial orientation, and manipulation of the environment
to
achieve the highest degree of perception and thought.

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Vision is a **BIG** Deal!

- As many as 50% of those with a neurologic injury suffer from visual changes—many are not diagnosed and go untreated
- 90% of concussion/TBI patients experience 1 or more ocular-motor dysfunctions
- 40% of concussion/TBI patients have visual dysfunction that persists > 3 months
- 70% of polytrauma patients complain of visual difficulties

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Two parts to vision

- - **Focal** vision: central, detailed, slow to react to movement (cerebrally processed), unmyelinated at birth
- - **Ambient** vision: peripheral, quickly reactive (brainstem processing), myelinated at birth

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Parallel Processing

Coupling of two separate processes in the brain:

- *Focal process = 80% of visual processing
 - Occipital Lobe; temporal/ventral stream
- *Ambient process = 20% of visual processing
 - Midbrain; parietal/dorsal stream

MUST work in **synchrony** to function well!!!



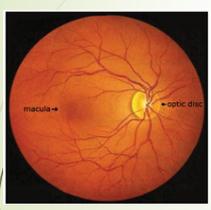
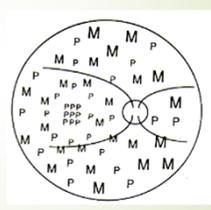
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Comparison of ambient and focal vision

<u>Focal Vision</u>	<u>Ambient Vision</u>
<ul style="list-style-type: none"> • P-cells • Macula • Conscious • Focal/Detailed/Bound to stimulus • Attention/Details/concentration (slow) • Unmyelinated at birth • Stimulus-Response (reactive) 	<ul style="list-style-type: none"> • M-cells • Periphery of retina • Preconscious • Ambient/Spatial/Not bound to stimulus • Movement, spatial orientation, posture, (fast – sympathetic, "fight/flight/freeze") • Myelinated at birth • Response-Stimulus-Response (anticipates change)

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P-cells (focal) and M-cells (ambient)

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Untreated Vision Problems Can...

- Can lead to a greater risk of reinjury
*Second impact syndrome
- Result in suboptimal recovery from TBI
- Slow the rehab process and interfere with participation in other therapies
- Can lead to greater difficulty in school as academic demands increase by grade level
- Can lead to adverse psychological sequelae, i.e. depression, anxiety

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How would you like to view the world like this?

double vision can look like this:

double vision
double vision
double vision
double vision

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How would you like what you read to look like this?

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Functional Vision Skills & Problems

Visual Perceptual Skills: ability to interpret, analyze, and give meaning to what we see

Visual Perceptual Skills	Examples of Functional Impairment
Visual Discrimination	Confuses the difference between "was" and "saw", between words
Visual Memory	Difficulty remembering what a word looks like, fails to recognize the same word on a different page, takes longer to copy
Visual Spatial Relations	Letter reversals, confuses right and left on self or objects
Visual Form Constancy	Struggles to recognize objects when turned a different direction, fails to recognize words that are presented in a different manner
Visual Closure	Confuses similar objects or words, especially words with close beginning or endings, difficulty recognizing inferences and predicting outcomes
Visual Figure Ground	Overwhelmed with a page with a lot of words, in the

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Automaticity

It is important that these visual skills become automatic so they take up **less brain power** to use.



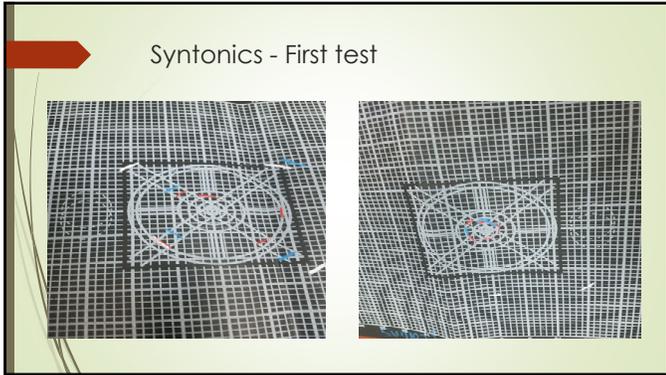
Automaticity is key to **efficient** information processing!

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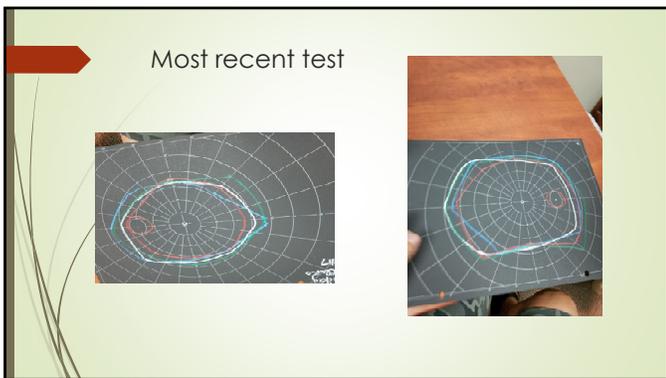
The Effect of PTVS on Cognition, Speech & Language and Motor Skills

- Phenomenon of "**focal binding**" or over focalization
- Anticipatory effect of vision and motor is compromised—**reactive vs. proactive**
- Movement becomes conscious and isolates function—**lack of automaticity**
- Movement in busy environments = **visual chaos**
- Lack of fluency with reading because unable to anticipate—**print becomes a mass of detail**
- Interference with **thought-language-oral motor flow**

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- OT Assessment
- Symptom Rating
 - Functional Limitations Rating
 - Acuity (eye sight)
 - Ocular-motor Skills (eye movements)
 - Accommodation (focusing)
 - Binocular Vision (eye teaming--alignment & vergence)
 - Visual Perceptual Skills (meaning to what we see)
 - Visual Motor Integration
 - Visual Midline Shift
 - Vestibular-Ocular Reflex
 - Visual Motion Sensitivity

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Visual Midline Shift Syndrome (VMSS)

Normal Perception of Midline

Perceived Midline

VISUAL MIDLINE SHIFT TEST

Normal Response

VISUAL MIDLINE SHIFT TEST

Visual Midline Shift To Right

Right Visual Midline Shift

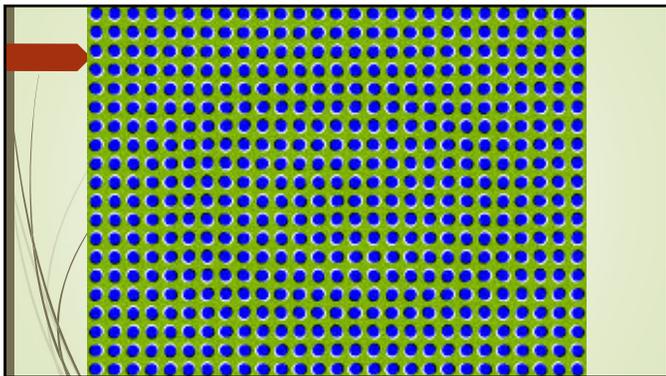
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Visual Midline Shift Syndrome (VMSS)

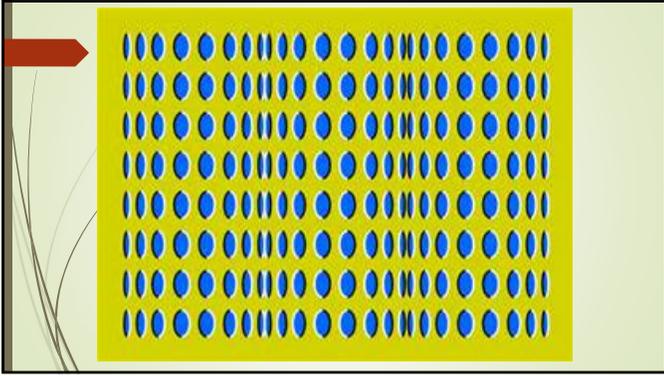
Common Characteristics:

- Dizziness or nausea
- Poor balance, coordination and/or posture
- Spatial disorientation
- Leaning forward / backward / one side
- Repeated injuries due to inaccurate perception of space
- Seeing the floor tilted
- Illusions of movement in the environment

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References

- Neuro-Visual Processing Rehabilitation, Padula, William V, et al
- "Two Modes of Visual Processing" National Research Council (US) Committee on Vision; Emergent Techniques for Assessment of Visual Performance. Washington (DC): National Academy Press (US); 1985.

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