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Vision and the Brain

**Occipital Lobe**
- Primary visual cortex
- Visual association cortex
  - Analyzing orientation, position, and movement.
- Initiation of Smooth Pursuit Movements
- Visual Field Loss

**Frontal Lobe**
- Saccades and Attention

**Temporal Lobe**
- Combines sensory information associated with the recognition and identification of objects such as people, places, and things.

**Parietal Lobe**
- Locating objects
- Eye movements
- Drawing/construction of objects
- Neglect
- Movement through space
Definitions

**Visual Perception** is the ability to interpret, understand, and define incoming visual information.

**Form Constancy** is the ability to identify objects despite their variation of size, color, shape, position, or texture.

**Figure ground Perception** is the ability to distinguish foreground from background.

**Visual Closure** is the ability to accurately identify objects that are partially covered or missing.

**Spatial Orientation** is the ability to recognize personal position in relation to opposing positions, directions, movement of objects, and environmental locations.

**Unilateral Inattention** is phenomenon that causes one to experience an inability to orient and respond to contralateral visual information.

**Depth Perception** is the ability to perceive relative distance in environmental objects.

**Visual Memory** is the ability to take in a visual stimulus, retain its details, and store for later retrieval.

**Visual Motor Integration** is accurate and quick communication between the eyes and hands.

**Visuocognition** is the ability to use visual information to solve problems, make decisions, and complete planning and organizational tasks through mental manipulation.

**Executive Functioning** is the ability to reason, plan, problem solve, make inferences, and/or evaluate results of actions and decisions.

**Memory** is taking in new information, holding on to information, and recalling information when needed.

**Information Processing** is taking environmental stimulation in through the five senses, interpreting it, and responding to it.

**Attention/Concentration** is staying awake, alert and ready, focusing, and keeping a train of thought.

  - Focused
  - Alternating
  - Divided
Objectives

1. Improve understanding of evaluation process for visual perception and cognition for adolescents and adults

2. Improve understanding of treatment techniques for visual perception and cognition for adolescents and adults, including bottom-up and top-down approaches, use of technology, and shoe-box treatment ideas

3. Identify impact of visual perceptual and cognitive barriers on everyday function
Objective One

- Improve understanding of evaluation process for visual perception and cognition for adolescents and adults

Without knowledge of where a deficit is located in the visual hierarchy, it is difficulty to design appropriate evaluation and treatment strategies (Warren, 1993).

- Impact of vision at each skill level of this hierarchy influences the overall integration of the visual environment.
- The foundation includes ocularmotor control, visual fields, and visual acuity. These are the basic visual skills required to take in information accurately from our visual world.
- Unilateral inattention is represented in this second level, and this deficit would complicate our ability to properly scan and attend to incoming visual information.
- Decreased visual scanning would present difficulties in pattern recognition, which includes (1) from constancy, (2) figure ground perception, (3) visual closure, (4) visual organization, and (5) spatial orientation. Moreover, the optimal functioning of pattern recognition skills are necessary for our ability to retain visual information, also known as visual memory.
- The highest skill level of this hierarchy is visuocognition, in which we are able to integrate visual perceptual information with other sensory input in order to complete executive functioning tasks, such as planning, problem solving, and decision making.
- Determining the cause of a deficit requires an understanding of how brain injury affects the integration of vision at each skill level and how the skill levels interact to produce visual perception.
Vision Screen

- **Visual acuity** – How clear it is. Screened using Snellen Charts for distance and near.

- **Accommodation** – The automatic adjustment of the eye for seeing at different distances. Screened using near acuity chart (or other reading material) and moving in until blurry.

- **Diplopia** – Another name for double vision. Note if this is in one area/quadrant only, or all the time.

- **Ocular pursuit** – The ocular motor skill of following a moving target with the eyes. Observe the client following a moving object such as a pencil eraser with their head still. Note lack of smooth movement, sluggish movement, overshooting or undershooting the target, and complaints of double vision or pain.

- **Saccadic eye movement** – Quick, simultaneous movements of both eyes in the same direction. Ask client to alternate gaze between one object and another rapidly. Observe for undershooting, overshooting, or searching for the target.

- **Convergence** – Coordinated movement of the two eyes so that the image of a single point is formed on corresponding retinal areas. Have the client follow an object (finger, pen, etc.) in toward their nose. Note distance from face when they cannot keep image single. Note if one eye breaks before the other. Approximately 4 inches is normal, however many can converge to the nose (TTN).

- **Visual scanning** – Coordinating eye movement in an organized fashion (efficient search pattern) while actively searching the environment for information (i.e. scanning a store shelf for a specific product, reading).

- **Depth perception** – The ability to determine the relative distance between objects, figures, or landmarks and the observer (i.e. the car in front of you or beside you when driving or parking a vehicle). Screened using the Stereo Fly Test or similar.

- **Suppression** – The neurological phenomenon of the brain’s ability to disregard information from one eye; suppression frequently results following prolonged double vision, and is thought a natural adaptation of the brain to try and make sense of the information received from the eyes. Tested through red/green activities such as the Worth 4 Dot Test.
## Visual Perceptual and Cognitive Screening

<table>
<thead>
<tr>
<th>Deficit Area</th>
<th>Clinical Observations</th>
<th>Quick Clinical Screening</th>
</tr>
</thead>
</table>
| **Form Constancy**        | • Difficulty following directions with pictures such as a recipe, building furniture, or learning a new board game.  
• Problems recognizing unfamiliar handwriting or new fonts.  
• Difficulty recognizing people wearing different clothing.  
• Difficulty in mastering the alphabet and numbers                                                                 | • Occupational Therapy Adult Perceptual Screening Test (OT-APST)  
• Functional Exercise:  
  • Locating various brands and sizes of items on a grocery store shelf  
  • Locating utensils and correct size bowls for baking tasks  
  • Reading directions to a game when words are in different fonts and colors                                                                                       |
| **Figure Ground Perception** | • Unable to sort and match socks while folding laundry  
• Difficulty locating clothing in drawers during ADLs  
• Missing road signs or vehicles when driving  
• Unable to locate toys in a toy box                                                                                                                               | • Bells Test  
• Occupational Therapy Adult Perceptual Screening Test (OT-APST)  
• Star Cancellation Test  
• Functional Exercise:  
  • Locating correct change during a money management activity  
  • Locating puzzle pieces during a jigsaw puzzle activity  
  • Locating classroom objects in a pencil box (ie. Glue stick, eraser, blue crayon, paper clip, etc)                                                                |
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<table>
<thead>
<tr>
<th>Deficit Area</th>
<th>Clinical Observations</th>
<th>Quick Clinical Screening</th>
</tr>
</thead>
</table>
| **Visual Closure** | • Cannot identify traffic signs that are partially hidden behind a tree or other vehicle  
                       • Difficulty locating items in the refrigerator that are partially covered | • Functional Exercise:  
                       • Completing partially drawn pictures or stencils  
                       • Identifying 10 common objects in an overlapping array of 30 items |
| **Spatial Orientation** | • Letter and number reversals  
                           • Difficulty with spacing and organization of written school work | • Occupational Therapy Adult Perceptual Screening Test (OT-APST)  
                           • Baking Tray Test |
| **Unilateral Inattention** | • Applying makeup or shaving only half of the face  
                                • Walking into furniture, doorways, and other objects  
                                • Eating food from half of the tray | • Occupational Therapy Adult Perceptual Screening Test (OT-APST)  
                                • Clock Drawing Test  
                                • Line Bisection Test  
                                • Bells Test  
                                • Star Cancellation Test  
                                • Albert’s Test  
                                • Comb and Razor Test  
                                • Baking Tray Task |
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<table>
<thead>
<tr>
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<th>Clinical Observations</th>
<th>Quick Clinical Screening</th>
</tr>
</thead>
</table>
| Depth Perception | • Misjudging distances while pouring liquids  
• Fender bender auto accidents, running stop signs  
• Difficulty with grooming, putting in contacts, placement of make-up  
• Difficulty with catching a ball | • Titmus Fly Stereotest  
• Randot Stereotest  
• Cover/Uncover Test  
• Functional Exercise:  
  • Navigating a therapy gym, hallway, or playground with obstacles  
  • Estimating common distances (ie: from person to a fixed distance point, such as a car)  
  • Pouring liquids into measuring cups |
| Visual Memory    | • Cannot remember sight words  
• Often transposes common words  
• Gets lost in familiar routes, or newly learned routes  
• Difficulty remembering faces or new people | • Clock Drawing Test  
• Scenery Picture Memory Test (SPMT)  
• Spot the Difference for Cognitive Decline (SDCD)  
• Functional Exercise:  
  • Study a photograph for 30 seconds, and describe the photo and items included  
  • Display an array of items or words, remove visual and report as many items as they can remember |
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<table>
<thead>
<tr>
<th>Deficit Area</th>
<th>Clinical Observations</th>
<th>Quick Clinical Screening</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Visual Motor Integration</strong></td>
<td>• Difficulty with letter formation and handwriting</td>
<td>• Occupational Therapy Adult Perceptual Screening Test (OT-APST)</td>
</tr>
<tr>
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<td>• Decreased participation in sports</td>
<td>• Clock Drawing Test</td>
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<td>• Decreased ability to complete a puzzle or construction of an object with pictorial instructions</td>
<td>• Trail Making A and B</td>
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<td>• Functional Exercise:</td>
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<td>• Write name or copy a sentence on paper</td>
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<td></td>
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<td>• Copy simple line drawings</td>
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<td>• Scissor along various dotted lines</td>
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<tr>
<td><strong>Visuocognition (Planning and Organizing)</strong></td>
<td>• Difficulty sorting and organizing personal belongings</td>
<td><strong>Visuocognition (Planning and Organizing)</strong></td>
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<td>• Difficulty sequencing and planning for an activity or game</td>
<td>• Trail Making A and B</td>
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<td>• Difficulty making sense of typed or written words, and sequencing a story</td>
<td>• Functional Exercise:</td>
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<tr>
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<td>• Sequence a recipe based on pictorial steps</td>
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<td>• Sequence a grooming task with displayed items (i.e.: toothpaste, toothbrush, faucet, towel, cup).</td>
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</tbody>
</table>
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<table>
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<tr>
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<th>Clinical Observations</th>
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</tr>
</thead>
</table>
| **Executive Functioning** | - Hard to narrow down the key point or main idea of something. Hard to choose the best possible solution to a problem.  
- Hard to come up with more than one way of thinking about something. Hard to see another point of view.  
- Problems evaluating how your plan is going, fixing mistakes, and changing the plan as needed.  
- Making Poor Decisions  | - Logic Puzzles  
- Packing a medication box  
- Problem solving picture cards  
- The Occupational Therapist's Cognitive ADL Workbook  
  - Decision making scenarios  
- Meal Planning  
- Scavenger Hunt in community  |
| **Memory**            | - Hard to hold on to even brief instructions or explanations. Difficulty remembering what was said at the beginning of a conversation.  
- Difficulty Storing New Information  
- Hard to recall the main point of a conversation, even if it just occurred.  
- May forget important things learned from experience, causing mistakes to be repeated.  | - Remembering 3/3 items immediately and after 5 minutes  
- Asking about current medications and precautions  
- Asking to recall previous meal  |
### Visual Perceptual and Cognitive Screening

<table>
<thead>
<tr>
<th>Deficit Area</th>
<th>Clinical Observations</th>
<th>Quick Clinical Screening</th>
</tr>
</thead>
</table>
| Information Processing | • Thinking Speed and Response Times are Slower. It takes longer to understand sensory information and make sense of what is going on in a situation. There may be a long pause before the person responds with words or behavior.  
  • Processes only Fragments of Information. Parts of information heard or seen may be missed. | • Trailmaking A  
  • Complete a following directions task  
  • Timed cancellation task  
  • Game of speed |
| Attention            | • Hard to Stay Alert  
  • Hard to Focus Attention. Easily distracted by noises and things around you. Distracted by personal thoughts, feelings, and worries.  
  • Lose “Train of Thought:“  
  • Difficulty alternating attention between tasks and losing their place  
  • Difficulty with attending to more than one thing at a time | • Trailmaking A and B  
  • Basic meal prep activity  
  • Grocery shopping exercise  
  • Cancellation task  
  • Reading medication labels |
• Baking Tray Test
• Clock Drawing Test
• Comb and Razor Test
• Line Bisection Test
• Trail Making A and B
• Bell’s Test
• Motor Free Visual Perception Test (MVPT-3)
  • Subtests for Visual Discrimination, Visual Figure Ground, Visual Memory, Visual Closure, and Visual Spatial.
• Test of Visual Perceptual Skills (TVPS-4)
  • Subtests for Visual Discrimination, Visual Memory, Visual-Spatial Relationships, Visual Form-Constancy, Visual Sequential-Memory, Visual Closure, and Visual Figure-Ground
• Developmental Test of Visual Perception Adolescent and Adult (DTVP-A) (DTVP-2)
  • Visual Motor Search, Visual Motor Speed, Copying, Figure Ground Perception, Visual Closure, and Form Constancy.
• The Occupational Therapy Adult Perceptual Screening Test (OT-APST)
  • Screens for agnosia, unilateral neglect, body scheme, constructional skills, acalculia, and apraxia scales.
• Rivermead Perceptual Assessment Battery (RPAB)
  • 16 Performance tests in areas of form constancy, color constancy, sequencing, object completion, figure-ground perception, body image, inattention, spatial awareness
• Loewenstein Occupational Therapy Cognitive Assessment (LOTCA)
  • 26 subtests in six areas including orientation, visual perception, spatial perception, praxis, visuomotor organization, and thinking operations.
Common Standardized Assessments

- Test of Memory and Learning (TOMAL-2)
  - Abstract Visual, Sequential, Linguistic, Numeric, Memory for Location, Object Recall, Facial Memory, etc
- Weekly Calendar Planning Activity (WCPA)
- Behavioral Assessment of Dysexecutive Syndrome (BADS)
  - Rule Shift Card Test, Key Search, Temporal Judgement, Zoo map, Modified 6 Element, Action Program
- Test of Everyday Attention (TEA)
  - Map Search, Elevator Counting, Visual Elevator, Telephone Search, Lottery
- Executive Function Performance Test (EFPT)
  - Oatmeal preparation, Telephone, Taking Medication, Paying Bills
- Symbol Digit Modalities Test (SDMT)
  - Verbal and Visual feedback
DTVP-A Copying Pre and Post Test
Objective Two

- Improve understanding of treatment techniques for visual perception and cognition for adolescents and adults, including bottom-up and top-down approaches, use of technology, and shoe-box treatment ideas.
Remediation Approach

• The remedial or developmental approach is typically initiated based on the premise that the brain can acquire or reacquire function through environmental stimulation.

• Reacquisition of skills should follow the original path of development.
  • In Piaget’s model of cognitive development, the lower level performance components are acquired prior to more advanced cognitive skills.
  • Treatment activities should place initial emphasis on foundational skills, regardless of the individual's level of functioning, in order to ensure that the foundation is solid prior to advancing to higher level cognitive skills.

• Choosing activities that have multiple levels of difficulty, the ability to alter speed requirements, and offer the opportunity to adjust levels of attention complexity are important to consider for grading activities up or down to foster meeting the client’s goals while considering his or her just right challenge.
Cognitive Loading Examples

- Active listening for recall of information
  - Music
  - Podcasts
  - News stories
  - How-to videos on Youtube
- Simplistic question and answer or categorical naming
  - Trivia Cards or Applications
  - Fitz It
  - Joe Name It
  - Respond Cards
- Alternating between multiple tasks
  - Following a sequential key
  - Self-timing transitions or following alarms
  - Self-structure or Structure the therapy hour activity
<table>
<thead>
<tr>
<th>Activity</th>
<th>Examples</th>
<th>Deficit Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Card Games</td>
<td>Mattel BLINK</td>
<td>Form Constancy</td>
</tr>
<tr>
<td></td>
<td>Set/ Set Jr</td>
<td>Figure Ground Perception</td>
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<td>Nertz/Peanuts/Dutch Blitz</td>
<td>Visual Closure</td>
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<td>Spot It!</td>
<td>Visual Organization</td>
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<td>Carl’s Cards</td>
<td>Spatial Orientation</td>
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<td>Fast Flip!</td>
<td>Unilateral Inattention/ Neglect</td>
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<td>Uno</td>
<td>Depth Perception</td>
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<td>Mattel Skip-Bo</td>
<td>Executive Functioning</td>
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<td>Swish™</td>
<td>Information Processing Speed</td>
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<td>On the Line/ On the Dot™</td>
<td>Memory</td>
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<td>Fluxx</td>
<td>Attention</td>
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<td>Board Games</td>
<td>Qwirkle™</td>
<td>Form Constancy</td>
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<td>Q-Bitz™</td>
<td>Figure Ground Perception</td>
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<td>IQ Twist™</td>
<td>Visual Closure</td>
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<td>I Trax™</td>
<td>Visual Organization</td>
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<td>Acuity</td>
<td>Spatial Orientation</td>
</tr>
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<td></td>
<td>Aztack™</td>
<td>Unilateral Inattention/ Neglect</td>
</tr>
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<td></td>
<td>Gravity Maze™</td>
<td>Depth Perception</td>
</tr>
<tr>
<td></td>
<td>NMBR9</td>
<td>Executive Functioning</td>
</tr>
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<td>Avalanche Fruit Stand</td>
<td>Information Processing Speed</td>
</tr>
<tr>
<td></td>
<td>Wonky™</td>
<td>Memory</td>
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<td>Connect 4®</td>
<td>Attention</td>
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<td>Guess Who®</td>
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<td>Kerplunk™</td>
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<td>Sequence/ Sequence Jr®</td>
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<td>Eye Found It®</td>
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<td>Cribbage</td>
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<td>Pandemic™</td>
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<td>Ticket to Ride</td>
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Form Constancy  
Figure Ground Perception  
Visual Closure  
Visual Organization  
Spatial Orientation  
Unilateral Inattention/ Neglect  
Depth Perception  
Executive Functioning  
Information Processing Speed  
Memory  
Attention
<table>
<thead>
<tr>
<th>Activity</th>
<th>Examples</th>
<th>Deficit Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yard Games</td>
<td>Ladder Ball</td>
<td>Form Constancy</td>
</tr>
<tr>
<td></td>
<td>Bean Bag Toss</td>
<td>Figure Ground Perception</td>
</tr>
<tr>
<td></td>
<td>Washers</td>
<td>Visual Closure</td>
</tr>
<tr>
<td></td>
<td>Can Jam®</td>
<td>Visual Organization</td>
</tr>
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<td></td>
<td>Horse Shoes</td>
<td>Spatial Orientation</td>
</tr>
<tr>
<td></td>
<td>Yard Darts</td>
<td>Unilateral Inattention/ Neglect</td>
</tr>
<tr>
<td></td>
<td>Putt Putt Golf</td>
<td>Depth Perception</td>
</tr>
<tr>
<td></td>
<td>Archery</td>
<td>Executive Functioning</td>
</tr>
<tr>
<td></td>
<td>Catch</td>
<td>Information Processing Speed</td>
</tr>
<tr>
<td></td>
<td>Table Tennis</td>
<td>Memory</td>
</tr>
<tr>
<td></td>
<td>Hopscotch</td>
<td>Attention</td>
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<tr>
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<td></td>
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</tr>
<tr>
<td>Tabletop/Shoebox Activities</td>
<td>Pixy Cubes™</td>
<td>Form Constancy</td>
</tr>
<tr>
<td></td>
<td>Labarynth</td>
<td>Figure Ground Perception</td>
</tr>
<tr>
<td></td>
<td>Find It®</td>
<td>Visual Closure</td>
</tr>
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<td></td>
<td>Beading</td>
<td>Visual Organization</td>
</tr>
<tr>
<td></td>
<td>Color/Paint By Number, Mandala</td>
<td>Spatial Orientation</td>
</tr>
<tr>
<td></td>
<td>Sand Art</td>
<td>Unilateral Inattention/ Neglect</td>
</tr>
<tr>
<td></td>
<td>Tanagrams</td>
<td>Depth Perception</td>
</tr>
<tr>
<td></td>
<td>Knitting/ Crocheting</td>
<td>Executive Functioning</td>
</tr>
<tr>
<td></td>
<td>Cross Stitch</td>
<td>Information Processing Speed</td>
</tr>
<tr>
<td></td>
<td>Where’s Waldo®/ Eye Spy Books</td>
<td>Memory</td>
</tr>
<tr>
<td></td>
<td>Bingo</td>
<td>Attention</td>
</tr>
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<td>Tactile Kinesthetic Pegboard</td>
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<tr>
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<td>Sewing</td>
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<td>Wordsearch, crossword puzzles</td>
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<td>Sudoku, Colorku</td>
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<td>Activity</td>
<td>Examples</td>
<td>Deficit Areas</td>
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</tr>
</tbody>
</table>
| Tablet Exercises  | *Subway Surfers©*  
*Cooking Fever©*  
*Candy Crush©*  
*Bejeweled©*  
*Temple Run©/ Minion Rush©*  
*Look Again!©*  
*Fruit Ninja®*  
*Glowburst©*  
*Minecraft©*  
*Find It - Match It©*  
*Vision Tap©*  
*Tap the Frog©*  
*iSays©*  
*Monster Hunt©*  
*Cut the Rope™*  
*Flow Free©*  
*Unblock Me©* | *Form Constancy*  
*Figure Ground Perception*  
*Visual Closure*  
*Visual Organization*  
*Spatial Orientation*  
*Unilateral Inattention/ Neglect*  
*Depth Perception*  
*Executive Functioning*  
*Information Processing Speed*  
*Memory*  
*Attention* |
| Gaming Systems    | *Nintendo Wii™*  
• *Big Brain Academy – Wii Degree*  
• *Wii Sports™*  
• *Guitar Hero®*  
• *Wii Play™*  
• *Wii Fit™*  
• *Band Hero®*  
*X Box Kinect/ 360®*  
• *Fruit Ninja™*  
• *Dance Dance Revolution™*  
• *Deca Sports Freedom™*  
• *Kinect Sports®* | *Form Constancy*  
*Figure Ground Perception*  
*Visual Closure*  
*Visual Organization*  
*Spatial Orientation*  
*Unilateral Inattention/ Neglect*  
*Depth Perception*  
*Executive Functioning*  
*Information Processing Speed*  
*Memory*  
*Attention* |
### Functional Therapy Activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure the Therapy Hour</td>
<td>Structure the Therapy Hour</td>
</tr>
<tr>
<td>Geocaching</td>
<td>Geocaching</td>
</tr>
<tr>
<td>Scavenger Hunts</td>
<td>Scavenger Hunts</td>
</tr>
<tr>
<td>Meal Planning and Preparation</td>
<td>Meal Planning and Preparation</td>
</tr>
<tr>
<td>Medication packing/pictographs</td>
<td>Medication packing/pictographs</td>
</tr>
<tr>
<td>Active Passenger</td>
<td>Active Passenger</td>
</tr>
<tr>
<td>Shopping</td>
<td>Shopping</td>
</tr>
<tr>
<td>Work simulation</td>
<td>Work simulation</td>
</tr>
<tr>
<td>Using public transportation</td>
<td>Using public transportation</td>
</tr>
<tr>
<td>systems</td>
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<tr>
<td>Applying make-up, putting in</td>
<td>Applying make-up, putting in</td>
</tr>
<tr>
<td>contacts</td>
<td>contacts</td>
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<tr>
<td>Shaving</td>
<td>Shaving</td>
</tr>
<tr>
<td>Laundry sorting/folding</td>
<td>Laundry sorting/folding</td>
</tr>
<tr>
<td>Home management activities</td>
<td>Home management activities</td>
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</tbody>
</table>

### Deficit Areas

- Form Constancy
- Figure Ground
- Perception
- Visual Closure
- Visual Organization
- Spatial Orientation
- Unilateral Inattention/
- Neglect
- Depth Perception
- Executive Functioning
- Information Processing
- Speed
- Memory
- Attention
- Executive Functioning
- Information Processing
- Speed
- Memory
- Attention

### Structure the Therapy Hour

**Activities with a *** must be done in the first 30 minutes**

**Activities with a **** must be done in the last 30 minutes**

#### MSU Museum Scavenger Hunt

**Animals in the following habitats:**

1. Tundra: __________________
2. Desert: __________________
3. Tropical Rainforest: ____________

**Two Types of Dinosaurs:**

1. __________________
2. __________________

**What is another name for the time period “Pleistocene Epoch” in the Hall of Evolution?**

**Where can you find the Eastern Garter Snake?**

**Name three types of owls found in the exhibits:**

1. __________________
2. __________________
3. __________________

**Find Lucy the skeleton. Where is she from?**

**Where are the elephant skeletons from?**

**Find a Piñata in the Hall of World Cultures. What culture**

### MSU Museum Scavenger Hunt

**Activities with a *** must be done in the first 30 minutes**

**Activities with a **** must be done in the last 30 minutes**

**Look up the weather for the upcoming week and write down below:**

**Organize deck of cards by suit in numerical order (Ace is high). Place suits in the following order on the table: Hearts, Spades, Diamonds, Clubs. Record how long this took here:**

**Call an auto service for price of standard oil change, write down here:**

**Locate Jayde Kennedy’s office between 2:55 and 3:10**

**Set an alarm for 3:15 pm on your phone**

**Participate in 3 rounds of Sushi Arrange iPad activity. Record the scores here:**

**Create a to-do list of at least 5 things you would like to accomplish over the next week**

**Identify the cost of Doritos in the vending machine between 2:45 and 2:50. Write down the code for purchasing this item here:**

**Complete two rounds of Color Erin Crush the on the iPad and record scores here:**

**Alphabetize the Organs Telephone Directory by first name. Highlight names with 5+ letters.**

**Complete two easy levels of IQ-Twist and write down the amount of time this takes you here:**
Handwriting before and after

Before VP Work

After VP Work

1. One Piece Butter Bread
2. 1/4 CUP MILK
3. Egg
4. twilight
5. tsp cinnamon
6. a pinch of salt
7. Chocolate Chips
8. C'inn Sugar

PLACE in mug
Compensatory Approach

- Compensation is a treatment approach that aims to maximize existing visual function by providing strategies to enhance the patient's ability to assimilate visual information efficiently.

- A compensatory approach should also place emphasis on understanding underlying difficulties in visual perception in order to learn when to initiate the use of strategies to overcome limitations.

- Rather than focusing on one task specific skill, the client should gain the ability to use the learned strategies in various situations.

- Warren supports the use of practicing strategies for visual perceptual deficits within context to ensure carryover of application to ADLs.
Compensatory Approach

- **Pattern Recognition**
  - Reducing overlapping objects
  - Changing spatial arrangements into categorized or linear arrays
  - Slowing down processing times
  - Forming proper scanning patterns
  - Multi-sensory techniques

- **Unilateral Inattention**
  - Prisms
  - Attention training
  - Scrolling text
  - Audiovisual stimulation
  - Video feedback training
  - Learn new scanning patterns
  - Lighthouse scanning

- **Depth Perception**
  - Monocular Cues
    - Shadowing
    - Lines of parallax
    - Superimposition
    - Prisms

- **Cognition**
  - Reduce stimulation
  - Rest breaks
  - Slowing down
  - Repetition!
  - Multi-sensory techniques
  - Verbalization
  - Chunking/grouping
  - Association
  - “W” Questions
  - Pro and con lists
  - STOP strategy
  - Double checking
  - Pre-planning
Objective Three

- Identify impact of visual perceptual and cognitive barriers on everyday function
Basic Activities of Daily Living

- Putting makeup on or shaving only one half of the face
- Difficulty locating shampoo amongst several toiletries
- Trouble locating clothing in a drawer
- Difficulty sequencing shower and dressing routine
- Unsafe transfers (depth perception or executive functions)
- Difficulty remembering a change to morning routine
  - For example, donning an AFO
- Difficulty resuming routine if interrupted
Functional Ambulation and Transfers

- Navigating curbs and uneven surfaces in the community
- Vehicle transfers
- Navigating stairs
- Colliding with walls and furniture
- Tripping over rugs and items on the floor
- Determining safe distance for transfers or sitting
Financial Management

- Difficulty locating account number on a bill
- Trouble remembering to pay bills
- Unable to follow columns while balancing a checkbook or while online banking
- Cannot recognize different coins
- Counting cash incorrectly for making payment or change
- Not able to follow a budget
Health Management

- Trouble remembering medical appointments and arriving on time
- Remembering to take medications or if they have been taken
- Difficulty accurately packing a medication box
- Cannot accurately read medication labels
- Trouble remembering information from medical appointments
- Missing prescription refills
- Difficulty remembering health information
  - Diagnoses
  - Precautions
  - Allergies
  - Specialists
  - Insurance information
- Cannot organize appointments and billing information
- Trouble identifying medications and the various forms and changes
- Trouble making decisions in health related emergencies
Shopping

• Trouble locating items in the store
• Bumping into displays while shopping
• Gets overstimulated in public
• Cannot remember where vehicle is parked
• Backtracking in the store due to poor organization and planning
• Unable to locate stores in the mall
• Overspending in the store
• Impulsively buying unneeded items
• Only attending to one side of aisle
Meal Planning and Preparation

- Difficulty pouring liquid ingredients
- Unable to identify appropriate utensils for use
- Cannot identify an appropriate weekly meal plan and grocery list
- Unsafe with heat surfaces and sharps especially when in the field of visual inattention
- Inability to sequence a recipe
- Forgetting to turn the stove or oven off
- Overcooking and burning food
- Not utilizing full baking sheet when making cookies
Home Management

- Cannot sort laundry
- Hitting walls and furniture while vacuuming
- Poor lines in the lawn while mowing
- Poor home organization
- Forgetting to take out the trash
- Difficulty staying on task
- Unsanitary sequencing while cleaning

I suffer from ADCD - Attention Deficit Cleaning Disorder. Start cleaning in one room, put things away, get distracted cleaning something else in another room. Ending up with more work which takes twice as long.
Community Integration

- Unable to identify road signs and pavement markings
- Stopping too soon or too late at intersections
- Unable to plan complex intersections
- Difficulty managing a bus route
- Requires assistance to schedule rides with transportation service
- Difficulty attending to navigation system while driving
- Only scanning one side of the environment and missing signs on the left side
- Poor lane management and speed control
Communication Management/Accessing Resources

- Difficulty scanning for information on phone book pages or websites
- Unable to identify appropriate search terms to locate information
- Cannot remember contact information for personal needs
- Unable to attend to a phone conversation and take notes
- Difficulty sequencing apps on your phone
- Decreased ability to identify the most appropriate professional to contact for person needs
Vocation and School

- Difficulty with alternating between projects, phone calls, e-mails, etc.
- Difficulty learning a new job task or role
- Unable to scan for and identify jobsite hazards
- Increased headaches from visual stimulation and lighting
- Difficulty reading small print text
- Cannot maintain organization of work space or school supplies/homework
- Decreased developmental progression of visual perceptual and cognitive processes impacting school performance
- Increased visual strain with screen time requirements
- Decreased ability to sequence and prioritize tasks
- Unable to multitask and retain information from meetings or conference calls
Questions?

Thank You
References


References Continued


