Presentation for: University of Bicocca

UNIVERSITÀ DEGLI STUDI DI MILANO BICOCCA

Laterality – Directionality Relationship to Reading And Remediation

Pacific University Oregon

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Special Thank You

Dr. Hannu Laukkanen

For sharing his insights into this topic, related photos and video clip.

Drs. Paula Luke and JP Lowery for also sharing background materials and advice

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Training Laterality and Directionality:

Review of Concept, Development and Impact on Patient

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Goals

- Provide general awareness of…
  - …laterality and directionality development
  - …problems associated with delayed development
  - …a clinical approach targeting improvement
    - …in overall development
    - …specific improvement with confusing English letters
- Present vision therapy case resolving vision-related learning problems including directionality

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What is Laterality and Directionality?

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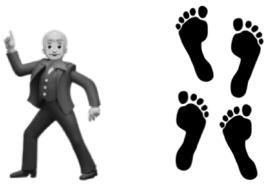
Laterality/Directionality

- Laterality: the ability to understand left from right
  - Understanding that my body has two sides that are different for task performance



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Laterality/Directionality

- Directionality: Project Left-Right concepts to position and motion of objects in space around us
  - Location awareness and communication
    - Where is (anything) compared to me?
    - Where is one object compared to another object?
  - Navigation

  - Print creation and identification

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The Potential Problem...

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Directional indicators to help you find your way

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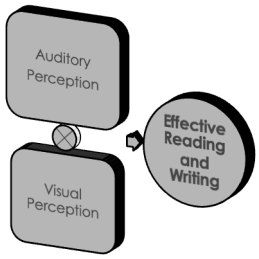
Many Factors Limit Reading Fluency



bad dad
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drab brad
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tyke

11

Many Factors Limit Reading Fluency

- Confusion of letter (or symbol) identification...
  - Logically, slows reading
  - Increases chance of incorrectly reading a word
  - Diverts attention needed for comprehension

bad dad
dab bab
drab brad

12

Many Factors Limit Reading Fluency

- Confusion of letter (or symbol) **creation**…
  - Results in challenges for the reader
  - May even create an incorrect word

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Development and Deficits of Spatial Relation Perception

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Laterality/Directionality

- Child first learns laterality of their own body
  - Tracks with corpus callosum development at age 4-5 (right-left hemispheres communicate better)
- Normal in Kindergarten-Grade 1 (age 5-7)
  - Many children still uncertain of left vs right at this age
- By 6-7 years, correct identification of right & left on self
- By 7-12 years, identification of right & left on others / objects
- By age 8, reversal errors indicate delayed laterality concept
- Assessment tools will include…
  - Piaget's Right-Left Awareness Test
  - Gardner Letter Reversal Frequency test

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Clinical Approach to Assessment of Laterality and Directionality Perception

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Assessment Question: Is Perception Development Typical For the Patient's Age?

- Basic (Natural) Left-Right Concepts
  - Patient's own left-right
  - Projection of left-right on others
  - Comparison of object positions relative to each other


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Assessment Question: Is Perception Development Typical For the Patient's Age?

- Basic (Natural) Left-Right Concepts
  - Piaget's Right-Left Awareness Test
    - OEPF.org
  - Patient's own left-right
  - Projection of left-right on others
  - Comparison of object positions relative to each other

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Assessment Question: Is Perception Development Typical For the Patient's Age?

- Correct Letter or Symbol Creation
  - Gardner's Reversals Frequency Test
    - OEPF.org
    - Write numbers and directional letters as told
    - May be able to rely on motor memory to assist

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Assessment Question: Is Perception Development Typical For the Patient's Age?

- Correct Letter or Symbol Recognition
  - Gardner's Reversals Frequency Test
    - OEPF.org
    - Cross out incorrectly oriented numbers or letters
    - May still try to rely on motor memory to assist

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Assessment Question: Is Perception Development Typical For the Patient's Age?

- Other tests to explore these areas also exist
  - There is need to develop other language-specific, language-relevant variations

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Deficits of Laterality and Directionality Perception

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Many Potential Reasons for Laterality-Directionality Perception Delay

- Developmental Lag
- Visual-Spatial deficit
  - Lack of Left & Right knowledge {laterality}
  - Inability to project laterality {directionality}

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Many Potential Reasons for Laterality-Directionality Perception Delay

- Ability to recognize letters or symbols is in two stages:
  1. individual features
     - May have as a core problem: visual analysis deficits
       - Visual discrimination
       - Visual memory/visualization
       - Figure ground
       - Visual closure
  2. directional orientation

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Corpus Callosum: Associated Behavioral Challenges

Corpus callosum development problem associations with poor readers

- Paul 2011: Effective callosal connections are uniquely essential for spatial, attentional, and motor skills
- Moore et al. 1995
  - Impairments in bimanual coordination
  - Integration of visuospatial information which may significantly impact reading skill

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Inherent Perceptual Challenge of Objects Versus Print

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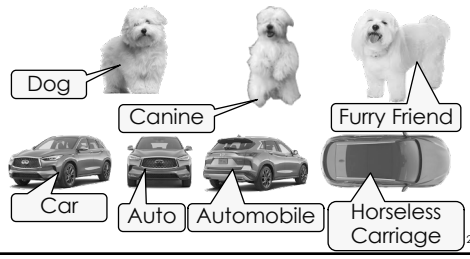
What if objects were called something else depending on the side you viewed?



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Laterality/Directionality
The Perceptual Challenge:
Some symbols ARE different depending on the side view?

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Clinical Approach to Laterality and Directionality Perception Therapy

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Training Laterality and Directionality:

Vision Therapy for Laterality and Directionality:
General Steps and Example Activities

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My Recommended Approach: General Steps Follow Development and Perceptual Complexity

- Awareness of own left-right
- Spatial projection of left-right
- Print or Symbol directional awareness
- Print or Symbol orientation creation
- Print or Symbol orientation recognition

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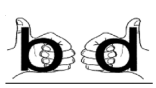
Getting Started with Therapy

- Patient needs a method to ALWAYS verify his/her own "left" and "right" before every activity
  - Examples:
    - Imaginary pencil "writing in air" with each hand to verify
    - Fist-bump "bed"
  - Repeat a method that works for them every time until R-L "internalized"



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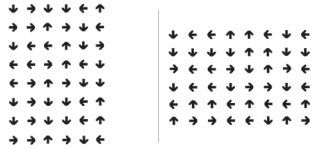
Awareness of Own Left-Right Example Activity: Kirshner Arrows

- Kirshner Arrow Chart Activities
  - Primary goal: confidence with own left – right
    - Encourage large gross motor movement
    - Initially, one line at a time and pause for next line
    - Notice: rotate the chart for "new" chart to avoid memorizing



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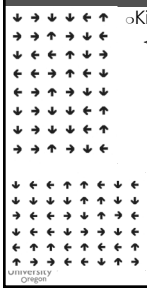
Awareness of Own Left-Right Example Activity: Kirshner Arrows



- Kirshner Arrow Chart Activities
  - Primary goal: confidence with own left – right
    - After success, try for more lines without pausing
      - Add metronome requiring arm movement and verbal response on the beat
        - Start slowly enough for EASY success
        - Increase about 5 beats per minute pace after mastery at current pace

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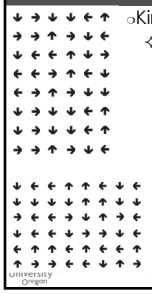
Awareness of Own Left-Right Example Activity: Kirshner Arrows



- Kirshner Arrow Chart Activities
  - Prescribing suggestion:
    - Depending on pace and mastery…
      - If struggling and slow, and only doing 1 or 2 lines at a time
        - 1 full chart total per day without any mistakes
      - If doing well and quickly, doing entire chart without stopping
        - Entire chart 2 or 3 times per day

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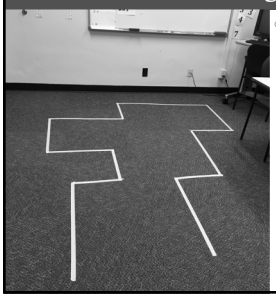
Awareness of Own Left-Right Example Activity: Floor Mapping



- Also called Left-Right Racetrack or Tank Commander
  - Masking tape maze on the floor
    - Precise 90° turns

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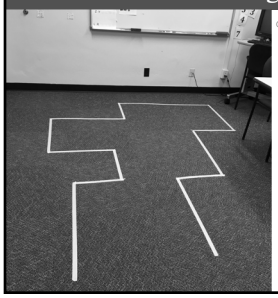
Awareness of Own Left-Right Example Activity: Floor Mapping



- Rules for all variations:
  - Tape must be aligned with patient's midline
  - Feet must be parallel with tape
  - Must completely stop before each turn
  - Response at each corner is clearly made

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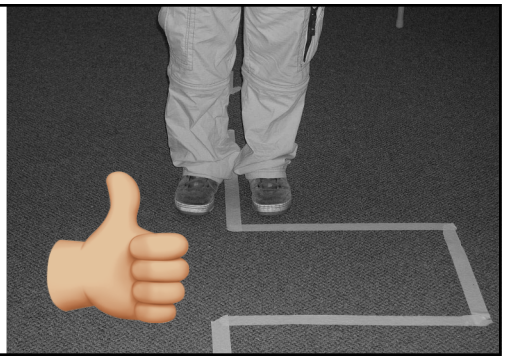

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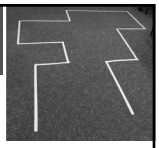
Awareness of Own Left-Right Example Activity: Floor Mapping



- Example response rules at EVERY corner:
  - Signal direction with arm movement
    - Again visualize writing hand if necessary
  - Say "Left" or "Right" out loud
- Provide feedback: "correct" or "crash & burn"
  - If correct: continue to next corner
  - If incorrect, restart maze from beginning

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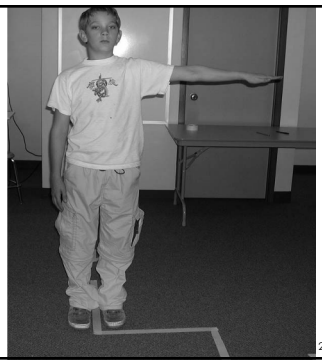
Correct signal turn with arm parallel to floor



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Head straight, arm down; visualize preferred hand; recall which arm signaled; CALL OUT TURN DIRECTION

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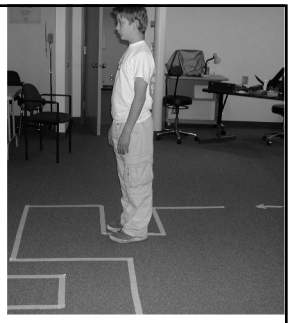
Go to next turn and stop, Repeat head/arm signal sequence visualization, then call out direction of the next turn



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General Steps Follow Development and Perceptual Complexity

- Awareness of own left-right
- Spatial projection of left-right
- Print or Symbol directional awareness
- Print or Symbol orientation creation
- Print or Symbol orientation recognition

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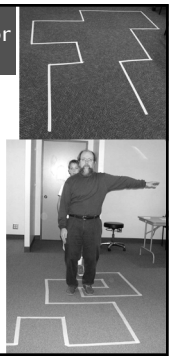
Projection of Left-Right Example Activity: Floor Mapping

- Stage One:
  - Patient moves through maze as just described
- Stage Two:
  - Therapist is "driven" through maze by patient instructions
    - Patient is right behind or next to the therapist
    - Therapist does the "arm signal" and patient says direction



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Spatial projection of left-right: Example Therapy Activities

- Rules for identifying Left-Right on an object or person:
  1) Where is the FRONT?
  2) Left and Right is based on where "forward" is aimed
  3) Practice this process:
     - Car
     - Dog
     - People

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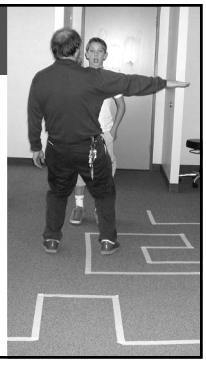
Projection of Left-Right Example Activity: Floor Mapping

- Stage Three:
  - Therapist is "driven" through the maze again
    - Patient STAYS AT THE STARTING POSITION
    - Notice difficulty when therapist is coming toward patient!
- Stage Four:
  - Drive imaginary car while standing next to maze



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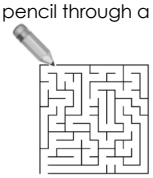
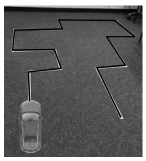
Projection of Left-Right Example Activity: Floor Mapping

- Single Object/Person: Floor Mapping-Next Stage
  - Consider applying same concept to…
    - …moving toy car through a route
    - …moving pencil through a maze





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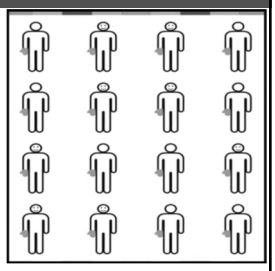
Projection of Left-Right Example Activity: Stickman

- Many other desk-based activities available
  - One example from series available from **www.visuallearningcenter.com** : Stickman Activity Packet



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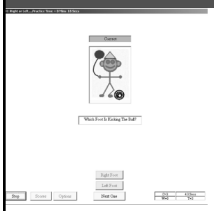
Symbol Direction Identification Example: Visual Thinking 101



- Right or Left
  - Mr. Stickman holds a balloon in right or left hand or kicks a ball with right or left foot
  - He may face or turn away from the patient
  - Determine quickly which hand or which foot is indicated

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Printed Symbol Direction Identification Example: Visual Thinking 101

- Right Left Grids
  - Mr. Stickman and all his friends are lined up in a grid of one, two, or three rows
  - Quickly determine which hand or which foot is indicated for each of the characters in the grid

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General Steps Follow Development and Perceptual Complexity

- Awareness of own left-right
- Spatial projection of left-right
- Print or Symbol directional awareness
- Print or Symbol orientation creation
- Print or Symbol orientation recognition

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Printed Symbol Direction Identification Example: Slap-Tap

- Slap-taps
  - Concept: slap the table with the left or right hand for each successive symbol
    - Can substitute feet on floor for hands on table

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Printed Symbol Direction Identification Example: Slap-Tap

- Slap-taps
  - Accuracy is required before speed!
  - Speed with accuracy is developed
    - Metronome encouragement may help

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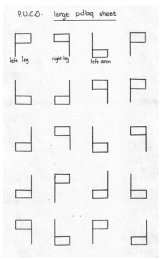
Printed Symbol Direction Identification Example: b-d-p-q sheet

- Similar to Slap-Tap, but with symbols that are similar to English language letters, or perhaps ARE English letters
  - Use hands for up-left and up-right
  - Use feet for down-left and down-right
  - Debate:
    - Is the cue the "ball or stick"?
      - My preference: stick



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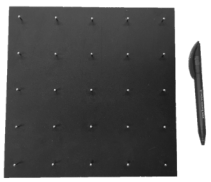
Printed Symbol Direction Identification Example: Geoboard

- Typically, use rubber bands stretched around the pegs to create a shape or pattern
  - Geoboards can be used for MANY therapy purposes
    - Here, it is to emphasize symbol direction/orientation



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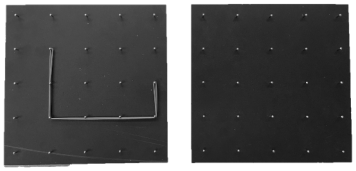
Printed Symbol Direction Identification Example: Geoboard

- Geoboard Pattern Creation



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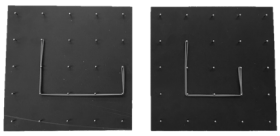
Printed Symbol Direction Identification Example: Geoboard

- After patient completes Geoboard Pattern Creation
  - Does yours look EXACTLY like mine?
  - What is different?
  - How will you fix it next time?
  - (undo their rubber bands) Do what you just said



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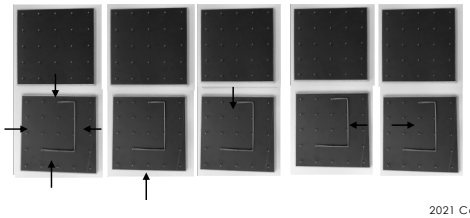
Printed Symbol Direction Identification Example: Geoboard

- Geoboard Pattern Creation
  - Directional Challenge: Make it as if you're on THIS side of it



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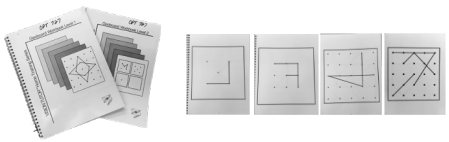
Printed Symbol Direction Identification Example: Geoboard

- Geoboard Pattern Creation
  - Workbooks available-progressive series



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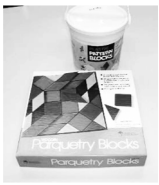
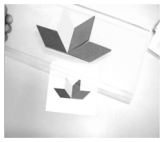
Printed Symbol Direction Identification Example: Parquetry Blocks

- Another item used for many purposes in therapy
  - Similar goal as with Geoboard, but key differences include:
    - Individual blocks: more positional options



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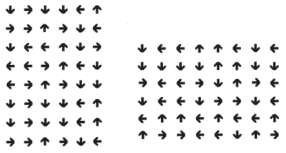
Printed Symbol Direction Identification Example: Kirshner Arrows

- Recall Kirshner Arrow Chart Activities
  - Here, the value is to identify the direction by VISION ONLY
    - This time: NO motor feedback, verbal ONLY
    - Load with metronome after initial mastery



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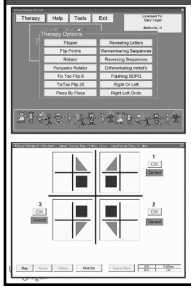
Printed Symbol Direction Identification Example: Visual Thinking 101



- Designed specifically for laterality and directionality problems

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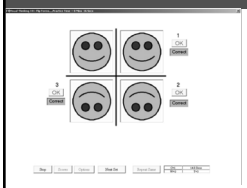
Printed Symbol Direction Identification Example: Visual Thinking 101



- EXAMPLE ACTIVITY: Flip Forms
  - Top-left is template
    1. Flip template image right-to-left in the first answer box
    2. Then flip it upside-down in the second answer box
    3. And, finally, re-flip left-to-right in the third box

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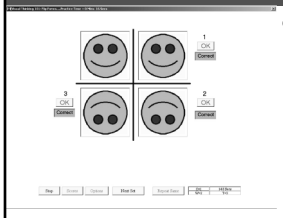
Printed Symbol Direction Identification Example: Visual Thinking 101



- EXAMPLE ACTIVITY: Flip Forms
  - The patient clicks through a series of images in various orientations until "correct" appears
  - Reaction times are tracked so they should think and answer quickly

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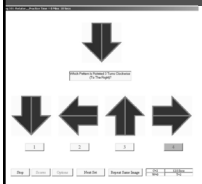
Printed Symbol Direction Identification Example: Visual Thinking 101



- EXAMPLE ACTIVITY: Rotator:
  - Similar to Flipper
  - Here, 4 rotated answer images will appear
  - Select the bottom image that answers the question about the target picture
    - "Which pattern is pictured 3-turns clockwise (to the right)?"

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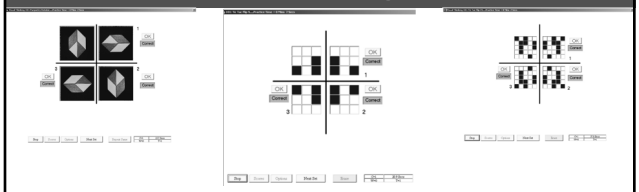
Printed Symbol Direction Identification Example: Visual Thinking 101



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Training Laterality and Directionality:

Vision Therapy for Laterality and Directionality:
General Steps and Example Activities

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General Steps Follow Development and Perceptual Complexity

- Awareness of own left-right
- Spatial projection of left-right
- Print or Symbol directional awareness
- Print or Symbol orientation creation
- Print or Symbol orientation recognition

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Printed Symbol Creation and Correction Example: Alphabet Writing Practice

- Alphabet Writing Practice
  1) Early in the day, write the entire alphabet with upper and lower case letters a b c (b) e f g h I j k l m n o p q r s t u v w x y z

     A B C D E F G H I J (K) L M N O P Q R (?) T U V W X Y Z
  2) Someone who KNOWS correct letters looks for errors
  3) For every error, a correct example is provided, then the patient copies ten times

d	d d d d d d d d d d
K	K K K K K K K K K K
S	S S S S S S S S S S

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Printed Symbol Creation and Correction Example: Alphabet Writing Practice

- Alphabet Writing Practice
  4) Later in the day, the corrected letters are tried again
  5) If still in error, an example is provided and copied ten times
     a) NOTICE: If all are correct in the morning, the activity is done for the day!
  6) Keep track of every letter needing correction or a point of confusion
     a) This will become the basis for the next activity

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Printed Symbol Creation and Correction Example: Letters in a Bag

- Letters In A Bag
  - For every troublesome letter, number or symbol, make (or purchase) 3 large cutouts and place in a bag

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Printed Symbol Creation and Correction Example: Letters in a Bag

- Letters In A Bag
  - The bag is held under a table so the letters cannot be seen

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Printed Symbol Creation and Correction Example: Letters in a Bag

- Letters In A Bag
  - One letter is selected, identified and correctly oriented BEFORE pulling from the bag
    - No further changes are allowed
    - If all is correct, it stays out of the bag
    - Otherwise, it is returned to the bag

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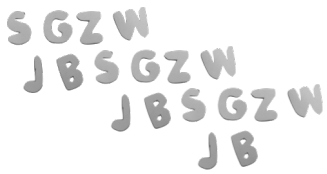
Printed Symbol Creation and Correction Example: Letters in a Bag

- Letters In A Bag
  - The activity continues until the bag is empty



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Printed Symbol Creation and Correction Example: Letter Transparencies

- Letter, number or symbol transparencies
  - Any combination of directional letters, numbers or symbols is typed into a document with moderate spacing between each

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Printed Symbol Creation and Correction Example: Letter Transparencies

- Letter, number or symbol transparencies
  - The document is printed on transparency material
    - CAUTION: not all transparency material is made to use in a printer!!!

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Printed Symbol Creation and Correction Example: Letter Transparencies

- Letter, number or symbol transparencies
  - Characters are cut apart, then scattered on a table
  - The goal is to correctly orient each character as quickly as possible
    - Can apply additional rules as desired, such as…
      - Place in a particular order
      - Spell words or make a sentence

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General Steps Follow Development and Perceptual Complexity

- Awareness of own left-right
- Spatial projection of left-right
- Print or Symbol directional awareness
- Print or Symbol orientation creation
- Print or Symbol orientation recognition

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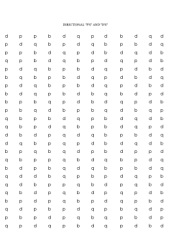
Printed Symbol Orientation Recognition Example: BDPQ Worksheets

- b-d-p-q Worksheets:
  - Used for many activites, all intended to improve directionality
- Example: Highlight all the "b's" in printed material
  - Then all the "d's", then "p's", then "q's"
  - Consider timing, with penalties for missing a character or going back to highlight a missed character
- Sometimes used earlier in place of other slap-tap sheets



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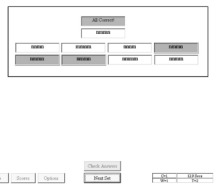
Printed Symbol Orientation Recognition Example: Visual Thinking 101

- Differentiating m, n, b, d
  - Random sequence of m's and n's OR b's and d's is presented
    - For example, mnnmnn or bbddbbdd
  - Choose all boxes below that display the presented sequence exactly



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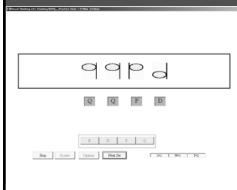
Printed Symbol Orientation Recognition Example: Visual Thinking 101

- Flashing bdpq's
  - Sequences of b, d, p, q are flashed
  - Task: reproduce the sequence
  - Sequence length and display speeds can be controlled
  - Target sequence can be flashed or continuous on the screen



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Printed Symbol Orientation Recognition Example: Letter Reversal Worksheets

- Reversed letter (character) worksheets
  - Words selected within current reading ability
  - One letter in each word is reversed
  - Identify this letter (circle or highlight)

away baby back

bear dean bell

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Printed Symbol Orientation Recognition Example: Other

- Other options include:
  - Many additional therapy activities, worksheets and programs exist for each therapy stage
    - Variations of instructions for each can adjust the purpose and difficulty
  - Many worksheets and software programs to assist each stage

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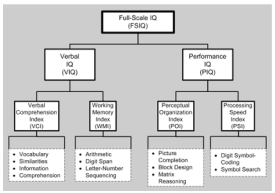
Which is better for Visual-Spatial deficit: computer therapy or conventional therapy?

- "Building Blocks for Developing Spatial skills" Jirout & Newcombe Psychological Science, 2015; DOI: 10.1177/0956797614563338



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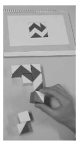
Which is better for Visual-Spatial deficit: computer therapy or conventional therapy?

- 847 children ages 4-to-7 yrs old
- Spatial outcome test measure: WPPSI-Block Design
  - Reproduce 2D patterns using half-red/half-white blocks



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Which is better for Visual-Spatial deficit: computer therapy or conventional therapy?

- RESULTS:
  - Children who played with puzzles, blocks, & board games "frequently" (> 6x/wk) had better spatial scores than children who played with them "sometimes" (3-to-5/wk), or "rarely" (< 3x/wk)
  - No other types of play (drawing, noise-making toys, bike or scooter riding, skateboarding) or parent-child activities (teaching number skills, teaching shapes, playing math games, telling stories) associated with spatial ability
  - Researcher's conclusion: targeting children's spatial play may be one possible intervention tool for improving spatial ability

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Final Comments

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Summary

- Concept of laterality and directionality have universal relevance
  - Deficits in development of spatial relations awareness are common and can be improved with targeted therapy

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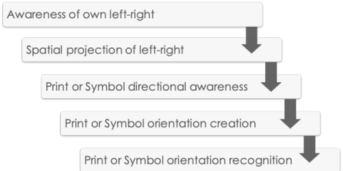
Summary

- Hierarchical framework of therapy provides structure to progression
  - Even in corpus callosum agenesis, there is potential for improvement of these perceptions and applications
  - Modifications for cultural needs, language, and functional goals can be developed from structure presented here



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Summary

- I hope you…
  - …recognized development challenge common to all demographics and potential causes
  - …found some logic to my approach to testing and training

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Recommended readings:

Vision Therapy: Training Laterality & Directionality, OEP Vol. 37/Number 1 pp. 1-16

Developmental & Perceptual Assessment of L. D. Children by Groffman & Solan pp. 39-43

Reversal Errors: Theories & Therapy by Kenneth Lane; Vision Extension 1988 pp. 1-6

Optometric Mgmt of Learning-Related Vision Problems, by Scheiman & Rouse (2006) pp. 263-265, 513-651

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