

## Direct Interventions for Language and Auditory Processing Disorders

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## The Interdisciplinary Processing Team

**Audiology**  
**Psychology**  
**Occupational Therapy**  
**Speech-Language Pathology**



## Team Vision

To improve patient care by defining discipline specific roles of information processing

## Achieving the goal

Disseminate educational information about each discipline's roles using consistent vocabulary and language. This will allow both referral sources and families achieve the most expedient and valid assessment and treatment for the child.



**Processing** typically describes the act of taking something through an established and usually routine set of procedures to convert it from one form to another, as a manufacturing procedure, such as processing milk into cheese. Processing can also refer to administrative procedure such as processing paperwork to grant a mortgage loan. - Wikipedia – the free encyclopedia

**Information processing** is the change (processing) of information in any manner detectable by an observer. – Wikipedia, the free encyclopedia



## Central Auditory Processing Disorders



### Auditory processing disorder (APD)

is broadly defined as a deficit in the processing of information that is **specific to the auditory modality**. It may be associated with difficulties in listening, speech understanding, language development and learning. In its pure form, however, it is conceptualized as a deficit in the processing of auditory input.

» (Consensus Conference, 2000)



### Behavioral Characteristics

- Family or teachers are concerned about child's hearing
- Poor reading and/or spelling skills
- Child often *mishears* information (i.e. "hot" for "hop")
- Difficulty hearing in noisy environments
- Parents most common complaint: Their child just doesn't seem to "get it"



## Central Auditory Processing Disorders/Auditory Processing Disorders

The ability to *hear* the message accurately.



Non-modality-specific cognitive processing and language problems may manifest themselves in auditory tasks (i.e., as listening problems); however, diagnosis of (C)APD requires demonstration of a deficit in the neural processing of auditory stimuli that is ***not due*** to higher order language, cognitive, or related factors.

American Speech-Language-Hearing Association. (2005). (*Central Auditory Processing Disorders—The Role of the Audiologist* [Position Statement]. Available from [www.asha.org/policy](http://www.asha.org/policy).)



### Role of Audiologist

- Manage and coordinate the transdisciplinary team effort
- Assess the status of the peripheral auditory system prior to any diagnostic CAP testing
- Design the specific audiologic test battery and conduct appropriate testing
  - Can control the environment
  - Can control test stimuli
  - Expert in the area of hearing and listening



## Referral Criteria

- Must have normal peripheral hearing sensitivity
- Children who are at least 7 to 8 years of age
- Children must be able to understand language and be able to communicate orally



## Referral Criteria

- Children with a significant speech articulation disorder are **NOT** good candidates - children must have intelligible speech
- Must be able to tolerate wearing headphones for at least one hour
- English must be primary language



## Test Protocol

- History (medical, educational and behavioral)
- Routine hearing test (pure-tones, tympanometry, acoustic reflexes)
- Series of central auditory processing tests (auditory figure-ground, dichotic listening, auditory closure, temporal testing, phonemic awareness)
- Counseling and recommendations



## Goals of the Audiologic Evaluation

- Identification of presence or absence of CAPD
- Identification/description of dysfunctional processes (dichotic listening, auditory decoding, temporal processing)
- Development of management strategies



## Speech-Language Pathology

### A Language Processing Disorder

refers to the child's ability to **understand the message.**



## Behavioral Characteristics

- Problems with following directions
- Problems understanding stories or basic concepts
- Trouble "getting to the point" or answering questions with the appropriate information



## Behavioral Characteristics

- Difficulty naming objects or people
- Difficulty knowing what to expect based on information they are given

The child may:

- Use slow or “choppy speech”
- Avoid talking



## Behavioral Characteristics

The child may:

- Speak in a monotone voice or speak too loud
- Mispronounce words that sound the same
- Use hands or body language when talking
- Avoid reading books



## Role of Speech-Language Pathologist

- Diagnoses written, reading, and verbal language processing and can SCREEN for APD referral to audiology



## Assessment

- Children of all ages can be tested.
- The assessment will take between 1-2 hours. It will evaluate the child's ability to understand what is spoken to and read to them and their ability to speak.



## Treatment Goals Designed to Address Functional Outcomes

- To achieve a child's maximum potential in deficit areas



## Evidenced-based Practice in the

diagnosis and treatment of APD (Moncrieff, Sept. 2007 in Hearing and Hearing Disorders, Research and Diagnostics)

- The principles of EBP are defined as “the conscientious, explicit and judicious use of current best evidence in making treatment decisions” and involves “integrating indiv. clinical expertise with the best available external clinical evidence from systematic research” (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996, p. 71)





## Behavioral Characteristics

- Poor coordination
- Difficulty with routine activities
- Short attention span, difficulty focusing
- Constant movement, cannot sit or stand still
- Does not like to be touched
- Poor reaction to sound
- Does not like to be in places with a lot of activity or noise



## Role of Occupational Therapist

- Participate in the transdisciplinary team effort
- Evaluate the individual's current level of functioning related to occupational roles and task performance
- Design and implement an individualized treatment plan to improve sensory processing in order to maximize participation in appropriate roles and typical daily tasks



## Referral Criteria

- Persons of all ages – infant through adult
- Experiences difficulty processing sensation impacting:
  - interaction with others
  - completion of daily tasks
  - the ability to assume appropriate roles within typical environments



## Evaluation Process

- History (medical, developmental, educational and behavioral)
- Clinical observation and completion of standardized and non-standardized assessment tools to determine which senses are affected and how significantly function is impacted
- Recommendations for establishment of ongoing services as appropriate



## Functional Outcomes of Intervention

- To improve sensory processing in order to:
- remediate inappropriate responses or challenging behaviors
  - compensate for challenges that continue to impact functional task completion and limit role participation
  - make environmental modifications that facilitate successful living



## Pediatric Neuropsychology



## Background

- Neuropsychology
  - Study of brain-behavior relationships
  - Functional neuroanatomy, and how to assess
- Pediatric neuropsychology
  - 2 year full time post-doc
- Services available
  - About 20 in Ohio, half in Cincinnati (Ala Ris)
- Beware the weekend workshopper



## Typical Evaluation Format

- 1-hour parent intake interview
- 3-hour testing session
- 2-hour testing session
- 1-hour parent feedback
- School visit, when feasible



## Typical Components

- Omnibus measures, typically IQ
- Adaptive behavior (critical in MR)
- Visuospatial/visuoconstructional fx.
- Visual memory functioning
- Motor functioning
- Sensory functioning (left parietal tests)



## Attention Assessment

- A critical rule-out diagnosis
- BASC a great tool, easy, cheap
- Psychomotor assessment (most sensitive)
- Divided attention (sensitive)
- Sustained attention (sensitive)
- Teacher and parent report
- Behavioral observation
- Focused attention (not very sensitive)



## Language Assessment

- Verbal IQ
- Woodcock-Johnson Academic Achieve.
- Verbal fluency
- Verbal memory (WRAML, TOMAL, CVLT)
- CELF-4
- Gray Oral Reading Test
- NEPSY
- Parent and teacher reports



## Other Procedures

- Parent Stress Inventory
- MMPI-A
- Category and/or Wisconsin Cards
- Mini International Neuropsychiatric Interview
- Malingering tests (rare with kids)



## Visual Processing



- Patient (Child) has problems reading
- Problems in school
- Need SPECIFIC information regarding what types of difficulties patient is having

## Chief Complaint



- Reverses letters
- Writes right to left
- Misspells words
- Confuses words with similar beginnings or endings (e.g. then and them)
- Problems identifying letters/ numbers/ words
- Better oral than written responses

## Signs/symptoms



- A group of visual cognitive skills used for extracting and organizing visual information from the environment and for integrating this information with other sensory modalities and higher cognitive functions

## Visual Information Processing



- Headaches
- Double vision
- Blurry vision
- Words move on the page
- Problems copying from the board
- Get tired when reading/near work
- Head turn/tilt

## Symptoms - Asthenopia



- Difficulty in finding specific item on a page full of information/scantron
- Difficulty recognizing a word in a paragraph vs. alone
- Difficulty in remembering what was read
- Problems learning alphabet/multiplication tables
- Spelling errors

## Signs/Symptoms



## Role of the Optometrist

- To determine if there are any visual efficiency problems present (primary examination)
  - The input of the visual system
- To determine if visual processing problems are present (secondary examination)
- To coordinate referrals among specialists



## Referral Criteria

- With suspected vision problems should have a comprehensive eye examination
- Does not need to know letters
- Generally ages 3 – 18
  - Most common ages 5-10 (grades K-5)
  - Can have symptoms in older children (to 16)
- No language requirements for initial exam



## Test Protocol

- Initial Optometric Evaluation
  - Comprehensive history (ocular, developmental, learning )
  - Assess visual acuity and refractive error (e.g. need for glasses)
  - Assess binocular skills (eye teaming) and accommodation (focusing)
  - Assess eye tracking
  - Rule out organic causes



## Subsequent evaluation

- Visual Processing Evaluation
  - Test battery
- Recommendations and referrals



## Goals of the optometric exam

- Treat a visual efficiency problem if present
  - Lenses, prisms, vision therapy (orthoptics)
- Treat a visual processing problem if present
  - Therapy, modifications
- Referral for additional treatment/testing if needed
  - Audiological, Psychological (IQ), OT, Reading Specialist



## Auditory Training in Quiet vs. Noise



## Auditory Training

- Detection
- Discrimination
- Vigilance
- Interhemispheric Transfer

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Temporal Gap Detection :  
leads to identification of pauses in  
conversation and text

- Ask the child to detect brief gaps inserted within brief bursts of white noise which are progressively shortened approaching criterion of 1 - 5 msec of gap detection.
- Use audiometer or even a child's electronic keyboard for stimulus presentation
- can use tape recorded samples or present live, realizing the poor temporal validity

09/26/05



## SOUND DISCRIMINATION (whether 2 stimuli are same/different)

### FREQUENCY DIFFERENCES

- Discern pitch differences (pure tones from audiometer to begin)
- Use available programs (Away We Go offers animal sounds, pitches, Earobics for vowel discrim.: Using Farmer Fardell), Fast Forward, Computerized Speech Lab)

09/05



## DISCRIMINATION (cont.)

- Tone Glide Discrimination
  - Determine the upward or downward direction of a fundamental frequency sweep for tone bursts of a few msecs.
  - Initially, the clinician can simply whistle sweeps or use **Away We Go!** (Martha) Or FF, but as accuracy improves, will need more valid stimuli from audiologist

09/05



## DISCRIMINATION (continued)

- Temporal tone order discrimination
  - tones with long & short durations, presented with audiometer or keyboard
  - listener task is to discriminate tone order
    - e.g. High - low - low
    - child can use colored poker chips or stacks of Leggos to represent the High vs. low tones, which removes verbal components from the task

09/16/06



## Pitch Discrimination Therapy Example



## Vigilance (sustained attention)

- Listener required to sustain attention to a continuous stream of auditory stimuli (such as environmental sounds, syllables, or words) and respond (e.g. raising hand or tapping table) when a particular target stimulus is heard. Computerized example is **Earobics 2 Hippo Hoops** (guest) for vowel vigilance
- Failure to detect = inattention
- False positives = impulsivity

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## Auditory Training of Minimal Pairs (Christine Sloan)

Discrimination of minimal syllable pairs of stop-consonants and fricatives consonants and short vowels (to reduce temporal cues in aiding consonant discrimination)  
voicing pairs; p/b, t/d, k/g; f/v, s/z  
– place discrim. Pairs; t/k, p/t, p/k, b/d, b/g, d/g; s/sh, z/v, sh/ch,

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## Sloan discrimination tasks continued

Therapy progression includes:

- sound in syllables
- minimal pair **WORDS**
- minimal pair contrasts of words embedded in sentences

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## Computerized minimal pairs

- **Away We Go!: Dog Deals the Deck** (guest)
- Can do this with your own minimal pair cards made using Boardmaker, using Sloan's suggested hierarchy of phonemes (typically strident and voicing errors are most common, as they provide less visual cues to the listener).



## TRAINING METALINGUISTIC STRATEGIES:

### AUDITORY MEMORY

## MEMORY

- Auditory Memory: Recall of auditory information in a variety of forms
- Auditory Memory: A Process (Gail Richards, 2001)



## MEMORY: EFFECT ON ACADEMIC SUCCESS

- CHALLENGES:
  - RECALLING ACADEMIC MATERIAL
  - RECALLING SOCIAL INFORMATION
  - RECALLING SOUND-SYMBOL RELATIONSHIPS
  - USING WORKING MEMORY ON DEMAND
  - INTEGRATING NEW INFO WITH EXISTING INFO

(Lanter, 2005)



## MEMORY: ST, REMEDIATION

- START WITH VISUAL PATTERN
- VISUALIZATION: Charts, Graphs, Pictures
- CHUNKING AND REPETITION
- PARAPHRASING
- MNEMONIC:
  - ABBREVIATION (CEO)
  - ACROSTIC (KING PENGUINS CONGREGATE ON FROZEN GROUND SOMETIMES)
  - ACRONYM (HOMES)



## MEMORY: ST, REMEDIATION ACTIVITY: CHUNKING

- 1950s George Miller study, “Magical Number 7, Plus or Minus Two”
- Chunking: Dividing a large group of words, numbers, or items into smaller, related units
- No right or wrong way



## MEMORY: MODEL (Levine, 2002) AND IMPROVEMENT STRATEGIES

- SHORT TERM MEMORY
- Brief retention, new info (released, forgotten)
- Deficiencies:
  - Chunking info
  - Registering info quickly
  - Making attention and memory work together



## MEMORY: ST, REMEDIATION ACTIVITY: VISUALIZATION

Goal: Increase memory skills for a list/sequence of items and build confidence  
Use velcro pictures or stickers:

- First person posts and names picture
- Next person adds a picture and names both
- Same person covers pics with paper and repeats sequence, pointing to general location
- Continue for each person's turn until they can no longer repeat
- Younger children, 6 items; age 10 and above, up to 16 items



## MEMORY: CHUNKING

Example: Phone Number: 5816647  
Example: Grocery List: 3 Breakfasts

Eggs  
Flour  
Milk  
Bacon  
Baking Flour  
Butter  
Syrup  
Cereal  
Blueberries



## MEMORY: CHUNKING

Sequence with pause

Rhyme

Space: Touch knee, nose, foot ear =

Touch ear, nose knee, foot

Category

Alphabet



## ACTIVE, WORKING MEMORY

- Info you need to complete a task
- Requires linking old skills to new system

### **Deficits:**

- Cannot remember information just read
- Cannot hold onto parts of task long enough to completion
- Cannot bind parts of memory together



## ACTIVE, WORKING MEMORY: REMEDIATION

- Identify main points while listening; underline while reading
- Review main points at appropriate breaks
- Identify key words and ideas in commands, auditory, written passages
- See handouts



## LONG TERM MEMORY

- The Warehouse for preserving knowledge, skills, life experiences

### **Deficits:**

- Cannot file information as pairs
- Difficulty following procedures
- Inability to remember rules as patterns – (including letter-sound correspondence)



## LONG TERM MEMORY: REMEDIATION

- Linking (Setting Light Cues)
- Physically Rehearsing (Learning to Parallel Park)
- Writing Information Down
- Drawing Diagrams, Charts, Graphs
- Repeated exposure to memory tasks – See Handouts



## TRAINING METALINGUISTIC STRATEGIES:

Non-Speech Acoustical Cues



## The Medium is the Message

- **BLINK:** Malcolm Gladwell:
- 93% of a Message is delivered via the nonverbal;
- 7% is delivered via the word choice



## METALINGUISTICS: NON-SPEECH CUES

- **Metalinguistics:**
  - The ability to reflect on language objectively
  - The ability to recognize the rules of humor, multi-meaning words, ambiguity, figurative language (simile, metaphor)
  - The ability to change MEANING of a message presented, in conversation, or in reading aloud, with the use of non-speech cues
  - Ultimately, the ability to segment words into syllables and sounds and to read



## METALINGUISTICS: NON-SPEECH CUES

- Children Who Lack Skills: GET IN TROUBLE:
  - May have poor musical ability
  - May have little or no expressive affect
  - May have difficulty perceiving expressive affect in others May misunderstand or confuse humor vs. sarcasm, a question vs. a statement or command, etc.
- ALL CRITICAL, PROSODIC CUES THAT KEEP US SOCIALLY APPROPRIATE



## PROSODY COMPONENT: RHYTHM

- The perceived regularity of prominent units in speech
- One option: Begin with Music Activities (handouts)
- Work heavily with:  
**PAUSE**



## NON-SPEECH CUE: PROSODY

- Rhythm
  - Stress
  - Intonation
- All show:**  
Emotional State  
Intent: Statement, Command, Question  
Mood: Ironic, Sarcastic, Sympathetic, Etc.



## NON-SPEECH CUE: RHYTHM: PAUSE

- 3 Reasons for Pause:
- Calls importance to word, phrase
- Gives receiver time for thought
- Gains back lost attention



## NON-SPEECH CUE: RHYTHM: PAUSE

Activities to Encourage Pause:

- Discrimination: Raise hand
- Mark Script with hash mark: Gradually fade script marks (Demo)
- Practice with ambiguous sentences where pause placement changes meaning



## ON THE IMPORTANCE OF THE PAUSE

Dear John:

I want a man who knows what love is all about you are generous kind thoughtful people who are not like you admit to being useless and inferior you have ruined me for other men I yearn for you I have no feelings whatsoever when we're apart I can be forever happy will you let me be yours  
Gloria



## NON-SPEECH CUE: STRESS

- To “punch up” or emphasize a syllable, key word, or phrase to relay meaning
- Use of stress clarifies what could be an ambiguous sentence
- Technique: Increase pitch and intensity (loudness)  
“I’ve told you THREE TIMES to clean your room.”



## NON-SPEECH CUE: STRESS

Order of Activities:  
Discrimination, then Demonstration, of appropriate stress for meaning in:  
Syllable  
Word Pairs  
Word in Phrase  
Word in Sentence



## Non-speech acoustical cues relating to punctuation marks & grammatical markers

Martha Coen-Cummings, Ph.D., CCC

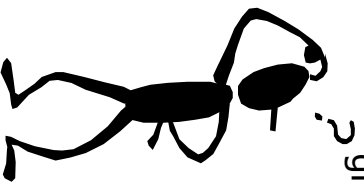


## Metalinguistic Overlays

- Non-speech acoustical cues
  - prosody
  - rhythm
  - stress
  - intonation
  - segmenting



Non-speech acoustical must be taught in association with punctuation marks & grammatical markers!



- Increase comprehension of conversation and text by using books on CD.

## Directly teach the associations

- Point out the correspondence between punctuation marks to the speaker's inflection and pauses:
- commas=breath,
- period= pause,
- questions=raise pitch,
- exclamation=intensity/stress

## Metalinguistic Overlays

- Non-speech acoustical cues that can change meaning of a message presented auditorily in conversation, or through sentences being read:
  - Prosody & inflectional cues can indicate questions vs. exclamation points vs. periods at the end of a sentence, etc. APPL YING these cues by the reader provides greater fluency to the text being read, and often greater comprehension.

## Metalinguistic Overlays (cont)

- Rhythm can completely change word meaning: RECORD (object) vs. rECORD (verb)
- Stress can impact KEY word understanding
- intonation can indicate sincerity or sarcasm
- Segmenting can change word meaning: They saw the CARGO on the boat vs. They saw the car go on the boat!

## Auditory Training for Metalinguistic

### cues

### Detection of SILENCE/PAUSE

- Discrimination of pitch patterns, intensity/temporal cues associated with sentences heard or text read
- Vigilance (noting when stimuli change)

## Temporal Gap Detection

- Ask the child to detect brief gaps inserted within brief bursts of white noise which are progressively shortened approaching criterion of 1 - 5 msec of gap detection.
- Use audiometer or even a child's electronic keyboard for stimulus presentation
  - can use tape recorded samples or present live, realizing the poor temporal validity

## SOUND DISCRIMINATION

(whether 2 stimuli are same/different)

- Frequency Differences
  - Discern pitch differences of approx. 5 - 10 Hz
  - can use available programs (Earobics Step 1: Farmer Fardell, Away We Go (Scientific Learning Corp Spaceship)
  - OR audiotape tone sequence of 2 notes presented in series of 3, from your audiometer or even piano and use in therapy

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## DISCRIMINATION (cont.)

- Tone Glide Discrimination
  - NORM = identification of durations of only 1 - 2 msecs
  - Determine the upward or downward direction of a fundamental frequency sweep for tone bursts of a few msecs.
  - Initially, the clinician can simply whistle sweeps, but as accuracy improves, will need more valid stimuli from audiologist

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Video example:  
High/Low tone presentation

Live presentation:  
Audience Training of pitch  
pattern application

Pitch rising = question mark or  
exclamation mark  
Pitch lowering =  
period/statement



## Audience Participation

Book on audio-tape/CD: listening for pause in the text being read to child, and indicating by a hand/finger raise when pause is recognized. WHILE text is seen

- Prior to session, xerox several pages from the book being read on CD, but "white-out" all grammatical markers.
- Have the child listen for ONE metalinguistic overlay at a time (e.g. pause to indicate sentence end, while looking for a capitol letter to follow: CHILD PLACES PERIOD ON XEROXED PAGE WITH COLORED PEN/MARKER.
- Lastly, turn off tape/CD, and compare child's grammatical markings to those of the actual text.

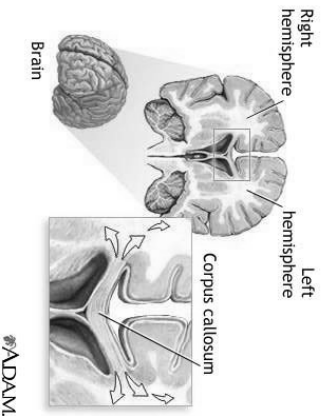
Continue auditory accuracy of pause  
identification: step 2



Videotape example of reading application of pitch changes

Interhemispheric Transfer

## Interhemispheric Transfer



What it looks like...

- *Key day-to-day behaviors:* trouble knowing "how to" do some task, tends to "watch and wait," poor starter, poor transitions, needs more time; lots of "I don't know," "I don't get it" or "I have no idea." Variable trouble in noise. Variable impact on communication. Academic effects in reading recognition, spelling, writing skills, other integrative tasks.

What it is...

- **Difficulty transferring information from the spatial area of the brain to the language area of the brain and a weakness in integrating and separating information presented to each side simultaneously.**
- **Difficulty bringing information together, such as sound symbol association or a connection between emotional affect and speech.**

Treatment for Interhemispheric Transfer

- **ASHA 2005:** Treatment and management goals are typically accomplished through three component approaches that are employed concurrently: direct skills remediation, compensatory strategies, and environmental modifications. Because interhemispheric transfer of information underlies binaural hearing and binaural processing, exercises to train interhemispheric transfer using interaural temporal offsets and intensity differences, as well as other unimodal (e.g., linking prosodic and linguistic acoustic features) and multimodal (e.g., writing to dictation, verbally describing a picture while drawing) interhemispheric transfer exercises are important additions to auditory training programs for many individuals.

## Environmental Modifications

- Acoustic enhancements
- Preferential seating . . . ?
- Assistive Listening devices
- AVOID multimodality augmentation
  - Bellis, Teri, 2006



## Compensatory Strategies\*

- Active Listening Techniques
- Problem-Solving
- Metamemory
  - Bellis, Teri 2006



## Direct Remediation \*

- Interhemispheric activities
- Dichotic Listening Training
- Localization Training
  - Bellis, Teri 2006



## What to work on...

- Interhemispheric activities:
- Verbal to Motor transfers: Find a specific object with left hand from a grab bag (you describe it, they find it)
  - Motor to verbal transfer: Find object with their left hand and verbally describe it (shape, texture, etc.)
  - Music therapy: Coordination of both hands (ex. Piano, guitar)
  - Singing : Linguistic output (left-side) and melodic expression (right-side)
  - Drawing: Describing the picture as they draw



## Ways to work on it...

*Recommended games/activities:*

- **Verbal to Motor transfers**
  - Feely bag (ex. Ned's head)
  - Twister
  - Battleship
  - Brain Warp
- **Motor to verbal transfer**
  - Feely bag (ex. Ned's Head)
  - Blind Man's Bluff
  - Obstacle Course



## Ways to work on it...

- **Music therapy**
  - Name that tune
  - Bop-it
- **Singing**
  - Piano lessons
  - Karaoke
- **Drawing**
  - Coloring book
  - Version of Pictionary

