What are Auditory Processing Disorders Really All About?

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Let’s Begin: How Do Professionals View AP & APD?
Most professionals today define APD as a disorder specific to the auditory system: an Audiocentric Approach. Thus, their focus is to evaluate and treat the AUDITORY system only. This position is supported by ASHA: 2005 ASHA Technical report, 2010, 2011 publications; AAA: 2000 Consensus Statement and 2010 position paper; EAA 2009 position paper.
Audiologists Stand on the Definition & Approach to APD

● The system specific deficit approach was presented by Cacase & McFarland
  ● System specific deficit means that APD **must** be identified a specific deficit to the central auditory system (CANS)
  ● Testing this system is best done by using non-linguistic tests and electrophysiological measures
  ● Name one measure that only involves the auditory system
Many professionals do not differentiate between *auditory processing* and *receptive language*

They say that the child has an APD because he/she failed language tests

They say that the child cannot have APD because he/she passed language tests
Lucker’s research
N = 90
Age range 5 to 17 years old
All seen for both auditory processing and language processing evaluations
All found to have normal cognitive abilities (lowest IQ scores = 90 or better; subtests 8 or better (both are the 25th percentile)
Pass = 25th percentile or better (SS = 90 or 8)
Fail = 6th percentile or lower (SS = 80 or 6)
For some APD tests, Pass ABOVE -1 SD and Fail BELOW -2 SD
Findings:

- N = 90
- 2% (2 children) failed only language tests
- 59% failed both auditory processing and language tests
- 39% failed only auditory processing tests

Can these 39% get services in schools?
Lucker’s Definition: Auditory Information Processing

- Those things the entire central nervous system does when it receives information through the auditory system and gets it to the brain where it eventually will form meaningful concepts

  - Auditory Processing involves auditory pattern recognition and discrimination
Auditory processing disorders come from one or more of six systems:
- Auditory
- Language
- Cognitive
- Behavioral/Executive
- Emotional
- Sensory

In some cases, the problem is with the integration of these six systems.
Lucker’s Categories: Sensitivity

- **Awareness, detection**, knowing that a sound exists (hearing loss vs. hyposensitivity)
  - Strategy = use non-auditory modes to communicate
- **Hypersensitivity** to loud sound
Lucker’s Research on Loudness Tolerance: Auditory Hypersensitivity

- Published in *Focus on Autism*, 2013
- 150 children not in the autistic spectrum
- 50 children with ASD
- 92% of children Non-ASD *could* tolerate sounds above 110dBHL
- 68% of children ASD *could* tolerate sounds above 110dBHL
- Auditory hypersensitivity is an emotional based problem not auditory problem - (also see Lucker & Dolman, *Autism Science Digest*, 2012)
Lucker’s Categories: Extraction

**Extraction =**
- Extracting the “code” from the ongoing flow of auditory information

**We extract at three levels**
- First = temporal (time)
- Second = phonemic
  - Distinctive Features
- Third = linguistic
  - Key Words
Lucker’s Categories: Attention

- There are really different levels of attention:
  - Set to attend – Selective attention
  - Focusing and filtering (relevancy)
    - Primary problem with APD due to poor filtering
    - **Tx Strategy:** Improve focusing on the primary message – improve processing of the primary message
  - **Maintaining Attention & Dividing Attention**
    - These are attention problems not APD
Lucker’s Categories: Memory or Storage

- Primarily a cognitive process and not an auditory process
- The auditory memory part of memory actually involves language
  - How we tag or label information when we place it in memory (which also involves cognition)
  - How we categorize and associate that information
- **Strategy:** teach relabeling, categorization, association, organization, mnemonics
- Also, check out **auditory overloading**
Lucker’s Categories: Integration

- Putting it all together
- Task analysis
- Problem solving
- Cognitive strategies
- Executive control
- Also, multisensory integration

**Strategy:** teach *metacognitive, metalinguistic, metaauditory* skills
We organize and sequence the events in messages.
In auditory processing, we always sequence information in the order in which we hear it.
We can have problems with certain tasks if we can’t sequence/organize properly.

*Strategy*: teach child use of Graphic Organizers and other external organization strategies.
- Be sure these organizational strategies work for the child.
Evaluating Auditory Information Processing

- We need a comprehensive assessment to look at all of the factors
  - Cognitive, behavioral, emotional testing by a psychologist
  - Language Testing by a speech-language pathologist
  - Auditory Processing Testing by an audiologist
  - Sensory systems assessment by an OT
Audiological Measures of APD

The first step is to measure hearing abilities (basic audiological measures)

- If hearing is normal, no compensation is needed for testing for APD
- If hearing is not normal, you may need to increase the intensity level and take special care in interpreting test findings
- Next you need baseline measures for hearing words (WRS-quiet), sentences (TCST 0%), phonemes (Nonword Repetition...
Evaluation of APD

- You need to evaluate each area of auditory processing
  - Hearing tests and baseline measure provide observations of client’s responses to get info regarding **hyposensitivity**
- Loudness Tolerance
  - See Lucker, *Focus on Autism*, 2013
  - This provides observations of client’s responses for **hypersensitivity**
Evaluation of APD

- Auditory Extraction
  - Auditory discrimination measures (using minimal contrasting words) - phonological
  - Nonword Repetition on CTOPP - phonological
  - Non-competing test items on SSW for lexical (also error analysis on Token Test for Children (TTFC) for lexical
  - Time Compressed Sentences (SCAN-3) for temporal
Evaluation of APD

- Distractibility vs. Attention
- For attention:
  - The Auditory Continuous Performance Test (ACPT)
    - Norms only from 6 years to 11 years – 11 months
  - Quick Responses and AYR/Yes responses on SSW
- For distractibility speech-in-noise/auditory figure-ground tests (+5, +8, +10, +12)
Evaluation of APD

- **Memory**
  - Order Effect on SSW
  - Digit Span memory tasks
    - Prerecorded on the Comprehensive Test of Phonological Processing (CTOPP)

- **Organization**
  - Reversals on SSW, Phonemic Synthesis Test (PST), and on digit span tests
Evaluation of APD

- Auditory Integration
  - Phonemic/Phonological
    - Mental manipulation of phonemes on the CTOPP
    - Blending words, nonwords
    - Segmenting words, nonwords
    - Elision
  - Lexical (linguisitic)
    - Competing measures: Words (CW) and Sentences (CS) on SCAN-3
    - Competing items on SSW
Token Test for Children (TTFC)

- Old test which has been updated, but updated (TTFC-2) version has **lost** the auditory processing analysis
- Only use first four parts
- All language is controlled, but the number of attributes (amount or load of auditory information) increases
- Evaluates following directions and auditory overloading
Interpretation

- You need to take all of the information and look for patterns
- Just using a typical Pass/Fail method does not work
- Also, you must integrate information from:
  - Psychological eval., speech-language eval., educational eval., other relevant evals.
Developing the Treatment Plan

- We need to consider these factors
  - Placement
    - School, class, program
  - Accommodations
    - Things we can provide to make processing easier
    - Maximize: learning, communication, listening
  - Remediation
    - Practice vs. developing strategies
  - What about APD as a label for diagnosis?
Diagnosis of APD

- Diagnosis done with ICD codes
- ICD-10 codes may be similar to ICD-9
  - 389.14 = Central hearing loss
  - 388.40 = Disorder of auditory perception
  - 388.45 = Acquired auditory processing disorder
- None of these medically related codes are helpful for schools
Auditory Processing Deficits (APD) are identified in the IDEA as auditory learning disabilities.

Read the IDEA and look under specific learning disability:

- A disorder in ..... understanding spoken language ..... [due to] imperfect ability to listen
- In the absence of hearing loss or SLI
Placement

- Children with just APDs do **not** need special education classrooms
- They can be educated appropriately in regular education classrooms
  - Mainstreamed – integrated
- They need accommodations (Section 504)
- They need educational services (IEP)
Accommodations

- Remember, **accommodations do not treat the disorder**
- Goal of accommodation is to provide equal access to the educational environment and curriculum
- We need to provide both accommodations AND treatments
Managing Children with APD: Accommodations

- FM Systems
  - Sound Field
    - Classroom
  - Personal
    - Headphones
    - Hear Aid type

- An FM system brings the speaker’s voice via the mic to the listener via loudspeakers or earphones through an amplifier

- Only personal systems appropriate for children with TRUE auditory distractibility problems
How many children with APD have auditory distractibility

Auditory distractibility based on APD (not attention deficits) affects the child’s abilities to understand speech in the presence of background noise.

Lucker’s research

Over 150 children evaluated for APD

- All came with one complaint being difficulties understanding speech in noise
- All were given three tests of SIN/AFG
- ~25% failed at least two tests of SIN and/or AFG
- Thus, ~75% had no problems with speech in noise
Accommodations Specifically for Children with APD

- Use of visual and gestural cues
  - Many children with APDs become more visually oriented than auditorily oriented

- Preferential Seating
  - What is the preference?

- Pre-teaching
  - Key word is **TEACH**!
  - Teach vocabulary, language, underlying concepts one week in advance of lesson
Treating APDs

- I will only discuss strategies for each of my categories of APD
- There are no BEST programs
  - Whatever works for you with the child is BEST for that child
  - The focus is on whether the goals, materials, and strategies fit the child’s individual APD needs
APD Training for Awareness & Recognition

- Teach children (esp. young children) auditory pattern recognition and discrimination
- Use three “containers” can’t see through
- Use two different things that make different sounds
  - Third container will have nothing in it
Underlying problem is **not** auditory but is emotional.

In Lucker & Dolman (2012), we discussed the strong link between the auditory system and the emotional systems in the limbic system of the brain.

It appears that **specially enhanced music** (listening therapies) interacts with the auditory system and the emotional system.
Lucker’s Preferences

- The Listening Program
  - (www.advancedbrain.com or www.thelisteningprogram.com)
  - Also, check out Sound Health Series

- Therapeutic Listening
  - (www.vitallinks.net)

- Samonas
  - (www.samonas.com)

- Integrated Listening Systems
  - (www.integratedlistening.com)
Earobics

- For *auditory phonemic awareness practice* (Phonemic Extraction)
- Does not provide any treatment
  - I define treatment as teaching strategies
- Thus, it is a tool, you, the SLP need to provide the strategies
- www.earobics.com or www.cogcon.com
Fast ForWord

- Was touted as **the** treatment for all APD problem
- Advertised to improve phonemic awareness/reading and spelling as well as language problems
- My research (2007) supports improvements in integrative processing and some improvements in speech of response processing
  - No significant improvements seen in auditory temporal processing on the input level

[www.fastforword.com](http://www.fastforword.com) or [www.scilearn.com](http://www.scilearn.com)
Lindamood-Bell Programs

- LiPS
- Visualizing & Verbalizing (V/V)
  - Also Seeing Stars (visual aspects of reading and spelling)
  - On Cloud Nine (math)
- www.lindamoodbell.com
- www.ganderpublishing.com
Lucker’s Application of LiPS

- First, go back to the beginning and teach child phonological awareness
- Begin with consonant sounds
  - How do phonemes sound (distinctive features)
    - Long vs. short (continuant/stop plosive)
    - Loud vs. soft or voice/voiceless consonants
- At this point, Lucker works on how are they made (production)
- Last modality is visual = speech/lip-reading
Lucker’s Application of LiPS

- Then go into word/sound analysis
- Sequencing phonemes to form words
- Analyzing words as to the phonemes in those words
- NO symbols used and NEVER use orthographic symbols
- The goal is mental manipulation of phonemes in words
Substituting Phonemes in Words

In this Context:

(Show me CAT)

(Now show me TACK)

(Now show me TICK)

(Now show me Stick? Etc.)
From Colors to Letters

- Spell words with colored pencils or crayons
- Use colors associated with the blocks
- Example:

  cat =

  c a t
Lucker’s Application of V/V

- Picture something, then describe that picture
  - Present ONE description (attribute) at a time
  - Child decides what could be described and provides support

- Order
  - Objects
  - Pictures
  - Words
  - Sentences
  - Stories

I don’t understand what you are saying. Please draw me a picture.
Using the same questions we asked for V/V for comprehension, we can develop sentences.

Start with a word and build from that word.
Using V/V for Organization

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nouns, subject</td>
<td>Verbs, actions, also “is”</td>
<td>Place, locations</td>
<td>Time</td>
<td>Reasons, because</td>
</tr>
<tr>
<td>Person, thing, animals</td>
<td>Action words and the “is” equals</td>
<td>In, on, under, etc.</td>
<td>Hours, days, seasons, etc.</td>
<td>Go back to action tell why it occurred</td>
</tr>
<tr>
<td>Descriptives are the adjectives = which?</td>
<td>Descriptives are the adverbs = how?</td>
<td>Descriptives are the adjectives = which?</td>
<td>Descriptives are the adjectives = which?</td>
<td>Links to a new sentence</td>
</tr>
</tbody>
</table>
Additional Activities for Auditory Extraction

- **Sound Play**
  - Encourage children to play with sounds or manipulate sounds in words
    - Just be careful of the words you use
  - The “Scooby Doo Game”
    - Take a sentence or phrase: “Hello, how are you?”
      “Fine thank you, and how are you?”
    - Substitute /r/ = “Rello, row rare rou?” “Rine rank rou, rand row rare rou?”
    - Then, substitute other phonemes
Activities for Auditory Extraction

- Use bisyllabic words switching around the syllables
  - Play “go fish” = “Do you have a ‘sillpen” “Do you have perpay?”
- Sing songs that play with phonemes
  - Name Game song, I Like to Eat Apples and Bananas…..etc.
- On a temporal level, speaking like “Charlie Brown’s teachers” (prosody training)
A Task to Develop Temporal Extraction Skills

- Use compound words like: fireman, hotdog, etc.
- Present pictures representing the compound word (fireman) and the two independent words (fire and man)
- Say the words and child has to identify whether you said the compound word (fireman) or the two individual words
Example #1
An Activity for Lexical/Word Extraction

- Problem with lexical extraction is that the child tries to decode everything he/she hears
- Listen for *key words*
- Teach the child how to identify and listen for key words and use only the key words in giving the directions
Sample of Lexical Extraction Giving Only the Key Words

- Rusty Knife
- Into Onion
- Hour
- Out
- Wash
- Wipe
- Rust Disappear
Strategies for Memory

- Teach child value of categorization as a way to remember:
- Chunking = regrouping = retagging or relabeling
- It is easier to remember 4 categories of 6 items each than to remember 24 individual items
- Have child make up mnemonics
Activity for Listening in Noise/Auditory Distractibility

- The goal here is to teach the child to FOCUS on the primary speaker regardless of what are the background distractions.
- Child has to localize the primary source of speech, face the direction of that source.
- Play the game as a variation of the “Marco Polo” game.
The Compass Activity

“Marco”

Child

“Polo”

Child

Child
The Compass Activity

- "Marco"
- "Solo"
- "Polo"

Child

Child

Child
The Compass Activity

“Marco”

“Molo”

“Polo”

“Solo”

child
The Compass Activity

“Marco”

“Polo”

“Molo”

“Solo”

“Bolo”
Another Activity for Integration

- This activity works on
  - Problem solving
  - Hypothesis testing

- Two ways
  - First using concrete, visual, manipulatives
    - Closed Set
  - Second, using only verbal
    - Open set
What Belongs in My House?
What Belongs in My House?
What Belongs in My House?
What Belongs in My House?
What Belongs in My House?
What Belongs in My House?
What Belongs in My House?

What’s the Answer?
Integration Activity at an Auditory Level only

- This game is similar to the House game, but...
- This is at the open set level (no visual clues)
- Whoever is “it” chooses a category for words that go together
  - Category can be auditory (such as all words start with same sound, they all rhyme, they all have the same vowel, etc.)
  - Category can be linguistic (such as all words are animals, etc.)
  - Category can be conceptual (support academic material)
Helping Children By Teaching Strategies

- Bottom line is that a strategy or “program” can be used forever.
- Child will need practice in applying the strategies.
- Ultimate goal is independent use of the strategy in a novel situation.
Case Studies
Case #1: 9yo, female, 3rd grader

- **Presenting problems:**
  - Difficulties following directions
  - Problems understanding teacher in class
  - Responding inappropriately to questions

- **Strengths:**
  - Does better when things are written than when purely spoken or when visual cues are provided
  - Does well in reading decoding – problems with comprehension in reading
Case #1: Test Findings

- Normal hearing
- Baseline all normal for words, sentences, phonemes
- Can tolerate >max
- Speech in noise all normal (+5, +8, +12)
- Filtered Words normal
- CW and CS not normal
- TCS not normal
Case #1: Test Findings

- SSW
  - Deficits in all four conditions RNC, RC, LC, LNC
  - Ear Effect normal
  - Order Effect normal
  - No reversals, Type A, AYR, Quick, Delays, Smush, Tongue Twisters

- CTOPP digit span normal
Case #1: Test Findings

- CTOPP all phonological measures normal (BW, BN, SW, SN, EL)
- ACPT: normal total errors, normal vigilance, qualitatively even error analyses
- TTFCC:
  - Part 1 and 3 normal
  - Part 2 and 4 abnormal
Case #1: Analysis

- Only deficits seen for:
  - SSW all four conditions
  - CW and CS
  - TCS
  - TTFC but only when a third attribute is added (size)

- So, what is her APD problem/area(s) of deficit (if any)?
Case #2: 12yo, male, 7th grader

- Presenting problems:
  - Difficulties following directions
  - Problems understanding teacher in class
  - Responding inappropriately to questions
  - Problems with foreign language
  - Problems with reading comprehension

- Strengths are primarily in non-verbal areas such as sports
Case #2: Test Findings

- Normal hearing
- Baseline all normal for words, sentences, phonemes
- Can tolerate >max
- Speech in noise all normal (+5, +8, +12)
- Filtered Words not normal
- CW and CS not normal
- TCS normal
Case #2: Test Findings

- Significant ear difference on all SCAN-3
- SSW
  - Deficits in Competing conditions RC & LC
  - Ear Effect significant REF
  - Order Effect normal
  - No reversals, Type A, AYR, Quick, Delays, Smush, Tongue Twisters
- CTOPP digit span normal
Case #2: Test Findings

- CTOPP all phonological measures normal (BW, BN, SW, SN, EL)
- ACPT: normal total errors, normal vigilance, qualitatively even error analyses
- TTFC
- Normal Parts 1 & 2 only
- Deficits Parts 3 & 4 when use two items
Case #2: Analysis

- Only deficits seen for:
  - FW, CW, CS on SCAN-3
  - Ear difference on SCAN-3
  - SSW RC and LC
  - SSW Ear effect
  - TTFC parts 3 & 4

- So, what is his APD problem/area(s) of deficit (if any)?
Case #3: 7yo, male, 2\textsuperscript{nd} grader

- Presenting problems:
  - Difficulties listening in general
  - Teachers, Parents question if he is listening or does not understand what is being said to him

- Previous testing
  - SLP in school NO PROBLEMS but had to repeat things to him several times

- No other testing done
Case #3: Test Findings

- Normal hearing
- Baseline all normal for words, sentences, phonemes
  - But, had to cue him to respond many times
- Can tolerate >max
- Speech in noise all normal (+5, +8, +12)
- Filtered Words normal
- CW normal - CS not normal
- TCS normal
Case #3: Test Findings

- Significant ear difference on two SCAN-3 SSW
- Deficits in all four conditions (RNC, RC, LC, LNC – many times no response at all)
  - Ear Effect normal
  - Order Effect normal
  - Reversals, Quick & AYR/Yes not normal
- CTOPP digit span not normal
Case #3: Test Findings

- CTOPP all phonological measures normal (BW, BN, SW, SN, EL) but needed to be cued many times to respond
- ACPT: Not normal total and vigilance nor for analysis of errors over time
- TTFC
  - Normal Parts 1 only
  - Deficits Parts 2, 3 & 4 when use two items
Case #3: Analysis

- Only deficits seen for:
  - CS on SCAN-3
  - SSW all four conditions
  - SSW Reversals
  - SSW Quick, AYR/Yes
  - TTFC parts 2, 3 & 4

- So, what is his APD problem/area(s) of deficit (if any)?
Case #4: 16yo, male, 9th grader

- Presenting problems:
  - All academic areas failing – very poor
  - Left back twice (elementary and HS)
  - Teachers feel it is attention

- Previous testing
  - SLP in school PROBLEMS in many language areas – mishears things you say to him

- Psychological no attention deficits, poor reading decoding and comprehension
Case #4: Test Findings

- Normal hearing
- Baseline all normal for words, sentences, phonemes
- Can tolerate >max
- Speech in noise **not normal** (+5, 0, +8)
- Filtered Words **not normal**
- CW **normal** - CS **normal**
- TCS **normal**
- Ear differences normal
Case #4: Test Findings

- SSW all normal
- CTOPP
  - Digit span **normal**
  - BW **normal**
  - BN **not normal**
  - SW **not normal**
  - SN **not normal**
  - EL could not do this task at all
Case #4: Test Findings

- ACPT: Normal but norms are only up to 11 years – 11 months
- TTFC normal all four parts
- Lindamood Auditory Conceptualization Test – Third Edition (LAC-3)
  - Failed test
  - Qualitative analysis
    - Could not segment phonemes OR syllables
Case #3: Analysis

- Only deficits seen for:
  - FW on SCAN-3
  - CTOPP all phonological
  - LAC-3 sound-symbol

- So, what is his APD problem/area(s) of deficit (if any)?
Let’s Keep in Touch

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