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## Back to Basics: Practical Aspects of Auditory Processing Disorders

Gail M. Whitelaw, PhD

Moderated by:  
Amy Natho, MS, CCC-SLP, CEU Administrator, [SpeechPathology.com](http://SpeechPathology.com)



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## Back to Basics: Practical Aspects of Auditory Processing Disorders

Gail M. Whitelaw, PhD  
Clinical Associate Professor/Clinic Director  
Audiologist  
The Ohio State University  
[whitelaw.1@osu.edu](mailto:whitelaw.1@osu.edu)



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- **Presenter Disclosure:** Financial: Gail Whitelaw was paid an honorarium for this presentation. Nonfinancial: Gail is the Advocacy Chair for the American Academy of Audiology (AAA), Program Chair for the Ohio Academy of Audiology, and Board member for the Audiology Practice Standards Organization (APSO) and the Accreditation Commission for Audiology Education (ACAE).
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## Learning Outcomes

As a result of this course, participants will be able to:

- Describe the characteristics of children with auditory processing disorders and how those disorders may relate to speech/language skills.
- List tests that may be used for assessment of auditory processing disorders.
- Identify appropriate recommendations to address auditory processing disorders.

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## The scenario

- A 9 year old child is referred to your clinic with concerns about hearing and listening. She has passed hearing screenings at school. She has difficulty with hearing in noisy environments. The teachers have completed a behavioral questionnaire (Screening Inventory for Targeting Educational Risk—SIFTER) and indicate significant concerns about listening skills.
  - Hoof beats and horses: Perform hearing evaluation and the results are “normal”
  - Now what?

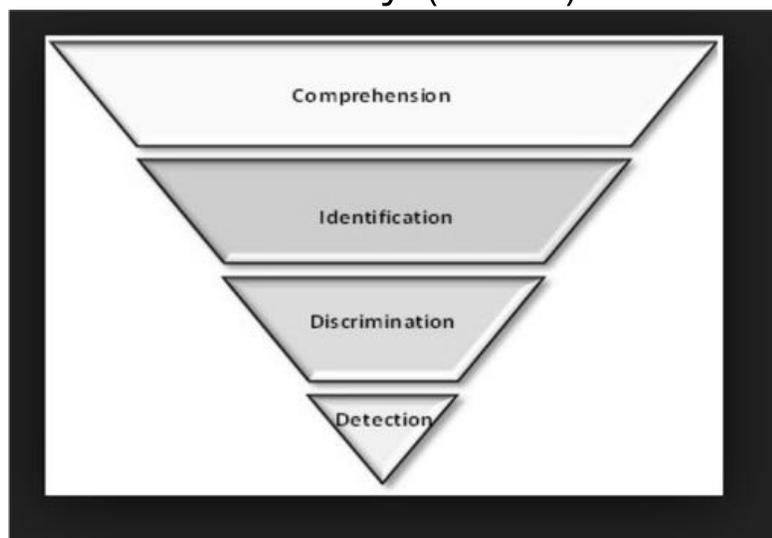
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## A different type of APD talk

- Looking for subtleties, looking for “functional” hearing difficulties
- Years of information on auditory processing disorder, not going to restate all of this
- This is a “call to action” talk
- How to address these issues with school-aged children

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## Erber's Hierarchy (1992)



## Redefine “hearing”

- World Health Organization challenges us to see hearing as “functional” communication
- We are learning more about issues like “hidden hearing loss”, auditory neuropathy, APD in those populations that provide evidence (e.g. Walter Reed, National Center for Rehabilitative Auditory Research, The Ohio State University)
- Environments that support all listeners provide redundancy and predictability

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## Recommendations for speech-language pathologists related to auditory processing disorders (APD)

- Stop questioning if this is “a thing”
  - Considerable peer-reviewed research to say “it’s a thing”
    - Jerger tells us that there are at least two distinct entities for auditory processing: Listening in noise (and includes dichotic listening—how information is combined between two ears) and temporal processing (timing, which involves reading, following directions, etc.)
    - “Hidden hearing loss”: speech in noise deficits also

Q2

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## Evidence for APD as a disorder? Fear of the “controversy”

- “...the quality and quantity of scientific evidence is sufficient to support the existence of APD as a diagnostic entity to guide the diagnosis and assessment of the disorder and to inform the development of more customized, deficit focused treatment and management plans”

ASHA, 2005

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## Evidence for APD as a disorder?

- American Academy of Audiology. (2010). Clinical practice guidelines. Guidelines for the Diagnosis, Treatment and Management of Children and Adults with Central Auditory Processing Disorder. Retrieved from [www.audiology.org/resources](http://www.audiology.org/resources)
- Define APD as “two different areas that are abnormal in the test battery”

Q3

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## (Central) Auditory Processing Disorders Defined:

- A breakdown in auditory abilities resulting in diminished learning (e.g. comprehension) through hearing, even though peripheral hearing sensitivity is normal

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## This is a “low incidence” population

2-5% of school-aged population (in contrast to hearing loss, 10-12% of the school aged population)

Continuum of hearing

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## Recommendations for speech-language pathologists related to auditory processing disorders (APD)

- Team is needed to assess auditory processing disorders
  - However, diagnosis of auditory processing disorders is in the scope of practice of audiologists!
  - Audiology wheelhouse
  - Just because a test has “auditory processing” in the name does not mean it assesses “auditory processing” (e.g. the Test of Auditory Processing Skills-4)

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## Recommendations for speech-language pathologists related to auditory processing disorders (APD)

- Auditory processing assessment: Control and consistency
  - Control of stimuli
  - Control of environment
  - Expertise in hearing/listening skills
  - Better evaluation tools are needed and are not coming quickly enough, but there are strong tools that provide control and consistency
- With this information, in conjunction with other information, a “differential diagnosis” is possible (e.g. this isn’t a type of autism, it is not ADHD, and it’s different than language disorders, but there can be comorbidity)

## Hearing: DeBonis (2015)

- Generalized hearing issues: DO NOT GUESS or GUESSTIMATE
  - Parental/teacher concern: The value of hearing screening in school
  - #1 indicator of hearing loss: Parental concern
  - You have a role here: Refer kids for audiologic evaluation! All kids where concerns are raised should have speech in noise testing (his “generalized listening issues”)
  - Best test for this is the Bamford Kowel Bench-Speech-In-Noise (BKB-SIN): Well normed and takes a very short time to administer
- Language is related to cognition and attention, and same concerns are raised

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## Beyond the audiogram

- Article on “Hidden Hearing Loss” in the ASHA Leader summer, 2017
  - Hidden hearing loss is described as the patient who can “ace” a standard hearing test but describe a struggle to hear in a noisy room

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## Recommendations for speech-language pathologists related to auditory processing disorders (APD)

- Push your audiology colleagues!
  - Tell them of the need for this testing and encourage them to do it well
  - Ask them to write reports that state what was done and what it means (drop the “50 cent” words)
    - Do not be wishy/washy with the interpretations
  - Provide appropriate recommendations and how to access those recommendations

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## Recommendations for speech-language pathologists related to auditory processing disorders (APD)

- Consider how this is handled in a school district
  - NO CONSISTENCY
    - Some districts classify on IEP as “hearing impaired”, some as “language impaired”, some as “other health impaired”, some as qualifying for a 504, some as a figment of the audiologist’s imagination

## Recommendations for speech-language pathologists related to auditory processing disorders (APD)

- Consider how this is handled in a school district
  - How does this functional deficit impact listening in the classroom?
    - Continuum of hearing/hearing loss
      - Children who have APD are sometimes as impacted or more impacted than those with peripheral hearing loss
      - Many of these children receive no service/supports in school

## Case of Connor

- Representative of so many students we have seen
- Parent report, however often supported by what has been stated by other professionals (and is often presented in writing)
- 18 year old and finally getting help
  - “Life changing”: solution started two weeks prior to our consultation
  - History of “ADHD” and “potential autism”
  - What he has: APD and receptive and expressive language processing (dismissed from treatment in 3rd grade)
- It takes a village!

## Developmental aspects of audition that go beyond detection of sound (refer back to Erber)

- Children, by virtue of childhood, need a more favorable listening environment than adults

Creating a welcoming environment to educate parents and professionals about typical auditory development

- Move away from “the audiogram says”

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## The Auditory System: The Earbone and Brainbone Have Always Been Connected

- Peripheral
  - Communication difficulties related to hearing loss
    - Conductive (OE/ME)
    - Cochlear (IE)
    - Retrocochlear (VIII nerve)
  - Usually more overt types of difficulties
- Central
  - Usually demonstrate no hearing loss via conventional audiometry
    - Subtle problem with “auditory processing”
    - Perceptual difficulty

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## Auditory Processes Are Mechanisms and Processes Responsible for the Following Behaviors:

(note: these are functional behaviors)

- Sound localization
  - Early behavior
  - Role in hearing in background noise
- Auditory discrimination
  - Gross and fine differences in sounds, including phonemes

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## Auditory Processes Are Mechanisms and Processes Responsible for the Following Behaviors:

- Temporal aspects of audition, including:
  - Temporal resolution, temporal masking,
  - Temporal integration, and temporal ordering
  - Timing is important in terms of reading, auditory memory, sequencing, etc.

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## Auditory Processes Are Mechanisms and Processes Responsible for the Following Behaviors:

- Auditory performance decrements with competing acoustic signals
  - Listening in the presence of background noise

CONTINUED

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## Auditory Processes Are Mechanisms and Processes Responsible for the Following Behaviors:

- Auditory performance decrements with degraded acoustic signal
  - Speakers that speak a dialect which differs from that of the listener  
(ASHA, 1996)

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## Assessment of Auditory Processing Disorders

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## Who labels the child?

- Auditory processing assessment and management is in the scope of practice of AUDIOLOGY
  - Audiologists cannot relegate or abdicate this responsibility to other professions (popular to use the term “auditory processing disorder”)
  - The “bowel-ear” connection—occupational therapy approach
  - A test like the TAPS is NOT an auditory processing test...addresses all the other things that DeBonis “complains” about

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## Audiologists unique qualifications to assess auditory processing skills...

- All auditory processing assessment is designed to “tax” the auditory system
- History of APD testing and all the ideas addressed above help to tax the auditory system
- The issue of language—varying linguistic load

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## Assessment begins with screening at time of request for appointment

- Age 7 as “standard testing”
- Value of assessment younger than 7 years of age if parent has concerns—role of the audiologist, however this assessment focuses on hearing/listening skills and not formal assessment of APD
  - Speech in Noise testing; ASA (Auditory Skills Analysis for 3-7 year olds)
  - Identify peripheral hearing loss!
  - Tremendous variability in listening behavior for younger children
    - Auditory system development issues

Q8

## Pre-appointment screening

- In call to set up appointment, establish the following:
  - Cognitive ability of the child
    - Criteria of normal cognitive abilities
    - Performance/verbal split
    - Criteria for learning disabilities (scatter)
    - Language bias of IQ testing
      - Nonverbal approach, such as the Leiter-3
    - Referral source

## Authentic assessment

- Screening tools completed by school personnel
  - SIFTER (<https://successforkidswithhearingloss.com/wp-content/uploads/2017/09/SIFTER.pdf>)
  - CHAPs  
[https://www1.phonakpro.com/content/dam/phonakpro/gc\\_hq/en/resources/counseling\\_tools/documents/child\\_hearing\\_assessment\\_childrens\\_auditory\\_performance\\_scale\\_chaps\\_2017.pdf](https://www1.phonakpro.com/content/dam/phonakpro/gc_hq/en/resources/counseling_tools/documents/child_hearing_assessment_childrens_auditory_performance_scale_chaps_2017.pdf)

Q6

## Authentic assessment

- Screening tools completed by school personnel
  - Fishers Auditory Problems Checklist
    - Available at the Educational Audiology Association at <http://www.edaud.org/>

CONTINUED

## Prior to APD assessment...

- Must have an audiologic evaluation; must establish NORMAL hearing for a child
  - What does this mean? 15 dB HL for all frequencies (known as the “low fence”)
- However, audiogram only tells part of the story
  - Speech in noise testing...Bramford-Kowel-Bench-Speech in Noise test (BKB-SIN)

Q7/Q10

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## Test materials available for APD assessment in children: Brief Overview

- SCAN-3 (Psychological Corporation)
  - Normed 5 years-11.11
  - Screening and Diagnostic subtests:
    - Filtered Words
    - Auditory Figure-Ground
    - Competing Words
    - Competing Sentences
    - Time compressed sentences
- SCAN-3: Normed for adolescents and adults

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## Test materials available for APD assessment in children (con't)

- Pattern perception skills (Pitch pattern sequence and Duration pattern sequence)
- GIN (Gaps in Noise)
- Multiple Auditory Processing Assessment Version 2 (MAPA-2)

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## Acoustic Pioneer

- Feather Squadron
  - <http://acousticpioneer.com/>

## Management of APD

### What doesn't work

- Doing nothing
- Preprinted list of recommendations

## What doesn't work

- Preferential seating: Please stop recommending this as a “fix” for auditory processing and hearing loss
  - Varies based on the environment—no “one” seat
  - Has no evidence that it changes the acoustic environment for the child (see Leavitt & Flexer, 1991)
  - May have other types of benefits such as logistical access to the teacher and/or visual access

Q4

## What doesn't work

- Acoustical “modifications” in the classroom
  - The tenet of if it's not measured, it doesn't happen
    - Tennis balls on the bottom of chairs
    - Use of soundfield FM in the classroom
- FM system as a panacea for all

## Linking assessment to management and treatment

- Compensatory strategies
- Improving the acoustic environment
- Direct intervention

## Key for all aspects of management and treatment

- Increase predictability
- Increase redundancy

## Compensatory Strategies

### Building a team

- Support from intervention specialists, speech-language pathologists, teachers of the hearing impaired, etc.: it's all about the team
- Develop understanding of child's strengths and weaknesses
- Encourage child to use visual cues
- Assist child in recognizing "easy" and "difficult" listening situations
- Teacher strategy development

## Teacher strategy development

- Teacher strategy development:
  - Impact of rate of speech on comprehension
    - “Clear speech” techniques (Payton, Uchanski, Braida, 1994)
  - Understand signal-to-noise-ratio and facilitate ways to enhance it
- Use of visual and other modality cues

## Auditory fatigue

- Recognize that listening is fatiguing; significant research to support listener fatigue at this time
- Schedule “listening” activities early in the day
- Alternate “listening” activities with those that require less listening
- Provide a quiet place to do work
- Opportunities for physical activity to reduce stress and improve attention
- Current research with focus on listening fatigue and stress in students with hearing loss

## Technology tools

- Speech to text options
  - Smartpens
    - Livescribe pen
      - <http://www.livescribe.com/en-us/smartpen/>
  - CPRINT/CC
  - Recording lectures
    - Front Row to Go Soundfield system with Lesson capture
- Guided notes, Powerpoints, etc.
  - Who is responsible?

An evidence based listening  
environment

## Hearing in noise

- The ability for CANS development to support processing of complex auditory signals, such as listening to speech in a room with a variable noise background, has a complicated developmental progression and extends well into adolescence (Sharma, Kraus, McGee, Nicole, 1997).

## Hearing in noise

- Johnson (2000) revealed that the more complex the noise listening situation (e.g. addition of reverberation, decrease in linguistic redundancy) of stimulus tasks resulted in a longer developmental trend for speech in noise performance
- The typical child in school requires a +6 dB SNR
- The “high risk listener” (Johnson, 2000) requires a +12-+20 dB

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## Improving signal to noise ratio for the listener with APD

- Personal FM/DM (digitally modulated) technology
- Mild gain hearing aids

Q5

CONTINUED

## Personal FM technology

- Superior Signal-to-noise ratio
- Quality of Sound: Clean, digital, dynamic
- Ease of use
- Fit: Easy to use but someone at school must be comfortable with a hearing aid type of device (e.g. removing wax from the tubing) for school-aged kids
- Options of receiver

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## Considerations with FM technology

- Authentic assessment
  - Specific observations
  - Use of a questionnaire, such as the Listening Inventory for Education (LIFE-R) (Anderson, Smaldino, and Spangler, 2011)
  - <http://lifer.successforkidswithhearingloss.com>
  - <http://lifer.successforkidswithhearingloss.com>
- Transparent system— not providing “amplification” per se, but signal-to-noise ratio enhancement only

## Hearing aids

- Have used in some children and many teens and adults with incredible success
  - Dodgeball accident
  - Softball patient
- Caution fitting normal hearing acuity
  - Medical clearance: Discuss with physician
  - Real ear measures
  - More “authentic assessment”
  - Data about listening in noise: Set it up in the booth
  - Kuk (2011)

## Hearing aids

- FM options are expanded when hearing aids are used
  - Can use FM receiver directly through hearing aid
  - Bluetooth connections
  - Use streaming device (Oticon Streamer, Widex FM Dex, Phonak ComPilot)
  - Possibility of improved hearing/listening with hearing aids only (Oticon Opn)



## All technology requires training

- Evidence that when people know what they are doing, outcomes are better ☺
- Audiologist should be the one who leads this
- Who provides batteries, domes, etc. for kids at school

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## Direct Therapeutic Approaches

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## Angel Sound

- <http://angelsound.tigerspeech.com/>
- Free, interactive listening rehabilitative program
- Research from House Ear Institute

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## Listening and Communication Enhancement (LACE)

- Listening and Communication Enhancement (LACE) program (developed by Robert Sweetow, Ph.D, distributed by Neurotone <http://www.neurotone.com/>)
  - Initially developed to address listening deficits in adults with peripheral hearing loss
  - Have used effectively with children and teens

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## Read My Quips

- <http://www.sensesynergy.com/>
- Designed by Harry Levitt, PhD.
- Focus is on speech comprehension, with average improvement of 30%

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## LisN and learn

- <http://capd.nal.gov.au/lisn-learn-about.shtml>
- Addresses speech in noise and dichotic listening
- National Acoustics Lab
- Use for students who have deficits with the LisN-S test
- Skills that are addressed: Localization; 3 dimensional listening
- Unique way to both test and address APD: new generation of tests and treatment with strong evidence base

## Hear builder

- <http://www.hearbuilder.com/get-hearbuilder/>
  - Phonological Awareness
  - Auditory Memory
  - Sequencing
  - Following directions
- Top down approach
- Functional issues and augment to APD but not likely to address specific auditory processing skills
- Has some of the components of an evidence based listening program

## Acoustic Pioneer

- Test battery administered as an App on iPad by an audiologist
- Age 5 thru adults
- Testing is “Feather Squadron”  
<http://acousticpioneer.com/assessmentapp.html>
- Treatment program associated with Feather Squadron:  
Auditory training games  
(<http://acousticpioneer.com/auditorytraininggames1.html>)

## Acoustic Pioneer

- Auditory training games
  - Zoo Caper Sky Scraper: Dichotic listening training
  - Insane Airplane: Tonal processing

## Capdots

- <http://capdots.com/>
- 3 levels based on age and skills

## Conclusions

- This population of children need our attention
  - Stop debating if this exists and start focusing on moving ahead to serve children while their brains/auditory systems are plastic
  - Refer appropriately and encourage audiologists to do our best
  - Advocate for appropriate services
  - The mantra “Low incidence population” and know that this is part of an interdisciplinary team
  - Listen and take action—if your first hypothesis doesn’t work out (e.g. language issue, ADHD) consider APD

## Questions/ideas/concerns

[whitelaw.1@osu.edu](mailto:whitelaw.1@osu.edu)

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