

**Processing “Processing Disorders”:
Eliminate the confusing redundancy!**

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Introduction to Processing

Background Information

- 1954 - Myklebust “auditory processing”
- 1962 - Vygotsky “processing”: relation between thought and words not a thing but process - continuous back and forth movement from thought to word and word to thought
- 1978 - Weisenberg & Katz “central auditory processing”: ability to receive & integrate auditory info
- 2005 – ASHA Working Group on Central Auditory Processing Disorders: perceptual processing of auditory information in the CNS and neural activity that underlies that processing

Impact of Processing on Learning

- 1967 - Johnson & Myklebust: LD-processing disturbance interferes w/ language comp. & verbal expression
- 1966 - Cruickshank: most LD result of processing deficits
- 1981 - Gerber & Bryen: processing difficulties result in school failure
- 2005 – ASHA Working Group: processing deficits may lead to or be associated with difficulties in learning

Relationship between Language Disabilities & Learning Disabilities

- Early language interactive with later learning
- Overt symptoms more subtle over time
- Preschool - delayed language
- Grade School - learning disabled
- High School - reading problems
- Adult - writing & pragmatic problems

Problems in Learning = Learning Disability: 80% or more are based in Language Deficits
Remaining 20% (or less) are based in sensory processing deficit or NVLD

Major Points to Consider

- The problem is NOT in reception of signal
- Repeating the signal is minimally helpful
- Individuals process stimuli in different ways
- Cues provide orientation, not the answer
- Processing occurs ‘on top’ of basic knowledge

DEFINITIONS

Processing: ability to abstract meaning from an acoustic stimulus (Massaro, 1975)
Processing: Ability to interpret or attach meaning to auditorily received information to then formulate an expressive response (Richard, 2001)

Processing Problems

* NOT

Mental retardation
Emotional
Motor speech
Neurological problem

Auditory Acuity
Language Acquisition

* IS

Normal IQ
Normal hearing acuity
Age commensurate language development

Typical Problems Resulting from Processing deficits

- Reading
- Spelling
- Splintered Academics
- Written Language

PROCESSING MODELS

Language Processing/Top Down

- Language info in mind of listener, not auditory signal
- Listener uses knowledge of language and world to interpret speaker's message
- Process acoustic signal using lexical/semantic knowledge
- Familiar processed quicker
- Discriminate significant features

Auditory Processing/Bottom Up

- Acoustic signal must be processed before being influenced by higher order knowledge
- Process acoustic info before linguistic info
- Sound identification necessary prerequisite to speech-language development
- Tallal research: children with LD- deficits in rapid transition of both linguistic and non-linguistic signals

Resolution

- Interactive
- Different kinds of processing dependent on task
- Times when focus on signal with minimal linguistic processing needed
- Times when hear message but can't understand message
- Most processing involves both signal processing & higher order processing
- Continual fluctuation between signal (auditory) and cognitive (language)
- Different processing styles

- Semantic Confusion

Continuum of Processing

X _____ X

Acoustic Processing
Audiologist

Phonemic Processing
Transition of A/SLP

Linguistic Processing
Speech-Language Pathologist

Neurological Continuum of Processing

	Anatomic Structure/Site	Type of Processing
Peripheral Auditory System	External, Middle, Inner Ear	Auditory Acuity; Reception of Signal
Central Auditory Processing	Central Auditory Nervous System ; Auditory nerve thru brainstem	Neurological Transfer of signal; Discrim of acoustic characteristics of signal
Phonemic Processing	Heschl's gyrus – temporal lobe	Discrim of phonemic characteristics of signal
Language Processing	Temporal Lobe – Wernicke's area and angular gyrus	Discrim of linguistic characteristics of signal; attach meaning using code
Executive Functions	Prefrontal/Frontal lobe areas; Motor Strip	Planning and executing response

- Test results help professionals develop *deficit-specific* management strategies
- Effective intervention of PDs includes: Remediation, Management, Neuroscientific Foundations

Acoustic processing

- Encompasses the peripheral and CENTRAL auditory nervous systems and includes:
 - Acuity and signal transformation
 - Binaural interaction
 - Auditory discrimination
 - Temporal processing
 - Dichotic listening

Peripheral Auditory System Function

Hearing sensitivity and reflex action

- Signal collection – outer ear
- Signal transmission – middle ear
- Signal detection – inner ear
- Signal transformation – 8th nerve

Brainstem level Central Auditory Functions

- Binaural interaction – how the two EARS work together
 - “additive” functions – provide a more robust signal for higher centers
 - “difference” functions – help with localization and hearing in noise
- Acoustic feature extraction: timing and frequency cues
 - Assists in signal perception
 - Different cells respond differently

Subcortical and cortical central auditory functions

- Auditory discrimination – ability to analyze fine acoustic differences in signal spectra
 - Occurs at thalamic level AND primary auditory cortex (Heschl’s gyrus)
 - Perception of ACOUSTIC signal
- Temporal processing – ability to use timing aspects of signal
 - Temporal resolution- a left hemisphere skill involving ability to perceive “1” versus “2” targets
 - Temporal patterning – a right hemisphere skill involving ability to perceive order/sequence
 - BOTH skills important for perception of running speech
- Dichotic listening – interaction between the two HEMISPHERES
- Reflects integrity of the left hemisphere, right hemisphere, and corpus callosum
 - Binaural integration: process all information presented to the two ears
 - Binaural separation: “hear” what’s in both ears BUT ignore one target or the other

Phonetic / Phonemic Processing

- Phonemic Processing Skills
 - Auditory Analysis / Segmentation
 - Auditory Attention
 - Auditory Association
 - Auditory Closure
 - Auditory Discrimination
 - Auditory Figure Ground
 - Auditory Localization
 - Auditory Memory
 - Auditory Sequential Memory
 - Auditory Synthesis / Sound Blending/Closure
- Preliteracy foundation
 - Sound-symbol correspondence
 - Spelling
 - Reading
 - Written Language
- Language /Linguistic Processing
 - Labeling
 - Stating Functions
 - Association
 - Categorization
 - Antonyms
 - Synonyms
 - Idioms
 - Analogies
 - Multiple Meanings
 - Stating Attributes
- Language Foundation for metalinguistic skills
- Ability to comprehend and express ideas through auditory to verbal modality
- Conceptual basis for higher level, more complex language

- Executive Functions
 - Attention
 - Inhibition
 - Planning and Organizing
 - Initiation and Persistence
 - Flexibility Self-Regulation
 - Goal Selection
 - Problem Solving
 - Working Memory
 - Impulsivity
 - Abstract Reasoning
- Ability to plan, organize, manage, execute response
- Coordinate and integrate the foundation skills from the temporal lobe
- Orchestra analogy

ASSESSMENT

- Differential Screening Test of Processing (LinguiSystems)
 - Screen continuum
 - 8 subtests delivered via CD rom
 - 3 auditory processing
 - 2 phonemic/phonic
 - 3 language
 - Identifies where to refer and/or spend more time in assessment
 - Available from LinguiSystems
- AUD and SLP = Team Approach
 - Differentiate auditory versus language aspects of disorder
 - Auditory aspects assessed by audiologist
 - Language aspects assessed by speech-language pathologist
 - Need to determine level of breakdown to program effective intervention
- Diagnostic CAPD Testing Battery
 - What? Battery of tests to determine how efficiently CANS operates
 - How? Overloading or overworking it
 - Who? Children as young as 6-7 yrs
 - Results compared to age-matched peers: Performance profiles yield insights to CAPD nature
 - *Minimize* influence of language, cognition & other sensory skills on performance
 - *Maximize* function of CANS
 - Results examined re: central auditory processes being taxed
 anatomical sites subserving those skills

Considerations for testing

- Status of peripheral hearing sensitivity
- Quality of expressive speech skills
- Receptive language skills
- Intellectual potential

Typical Components of Central Auditory Evaluation

<u>Test Type</u>	<u>Processes assessed</u>	<u>Underlying site</u>
standard audiometric tests puretone air/bone speech thresholds word recognition	hearing sensitivity/acuity	peripheral system
standard immittance tests tympanogram acoustic reflexes	signal transmission	peripheral/central
monaural low redundancy low-pass filtered speech time-compressed speech	auditory closure auditory discrimination	auditory cortex/LH
binaural interaction tasks binaural fusion masking level difference localization games	interaction between the ears	brainstem
binaural separation tasks competing sentences	neuromaturation separation	RH/LH/corpus callosum
binaural integration tasks dichotic digits dichotic rhyme staggered spondaic words dichotic CVs competing words	closure integration sequencing	RH/LH/ corpus callosum
temporal processing tasks gap detection tests patterning tests	temporal resolution temporal patterning	RH, LH, CC
speech-in-noise tests	varied	varied

Test Interpretation

NOT CAPD:

- Performance below normal on single test
- Performance below normal on all tests

Evidence of CAPD

- Poor scores on *sets* of tests tapping similar function
- Bellis/Ferre model describes 5 test profiles

Summary of CAPD types

- Primary types
 - Represent true *central auditory processing deficits*
 - Decoding deficit – LH, the “what” kids – poor analyzers
 - Integration deficit – CC, the “how to” kids – poor synthesizers
 - Prosodic deficit – RH, “blah-blah-blah” – poor analysis & synthesis of patterns in speech
 - Secondary patterns observed on testing
 - Probably seeing the audiological manifestations of other neurocognitive deficits
 - Associative deficit – probably a language processing issue, not auditory – missing the *meaning*
 - Output-Organization deficit – probably executive function, attention, or planning deficits – can’t get it out well
- **SLP Assessment**
- Audiology has been neurological in assessment approach
 - Speech-language pathology has been very behavioral in assessment approach
 - SLP needs to become more neurological in approach; realize that brain mediates behavior
- SLP Assessment Concerns
- Does child accurately receive signal?
 - Does signal accurately transfer through the Central Auditory Nervous System to upper cortex?
 - Can child retain signal long enough to analyze signal (e.g., identify sound segments)?
 - Does child comprehend/understand what the signal means?
- SLP Assessment
- Auditory only; visual adds compensatory
 - Begin in overlap area
 - If fail miserably, refer for central auditory assessment
 - Assess phonemic awareness of signal
 - Hierarchy of language complexity
 - Begin simple and discrete
 - Increase language demand
 - Battery of tasks/tests
- Language Processing Assessment
- ‘Normal’ hearing
 - ‘Normal’ receptive language
 - Primary, secondary, tertiary zones
 - Auditory memory
 - Word retrieval
- Processing Assessment
- Receptive Language Developmental Level
 - Primary Zone - Functional Auditory Skills
 - Secondary Zone - Hierarchy of Language Complexity
 - Tertiary Zone - Integration of Language into Executive Functions
 - Supplemental - Memory; Word Retrieval

- Non-Audiological / Functional Assessment by SLP
 - Assessing different phenomena
 - Can't do in isolation
 - Need to understand author orientation
 - Know if assessing auditory or language
 - Specific Tests / Assessment Areas of Auditory Perception
 - Auditory Discrimination
 - Auditory Memory
 - Auditory Figure Ground
 - Sound Blending
 - Example Assessment Instruments for Functional Auditory Skills
 - ITPA Goldman-Fristoe Woodcock Series
 - SCAN Phonological Awareness Test

- Sample Secondary Zone Hierarchy – LPT
 - Labeling – nouns
 - Functions – verbs
 - Association
 - Categorization
 - Similarity
 - Difference
 - Multiple Meaning
 - Attributes

Secondary Zone Assessment

- Language Processing Test
- WORD Test
- Comprehensive Assessment of Spoken Language (CASL)

Tertiary Zone Assessment

- Test of Problem Solving
- CELF
- Listening Test
- Detroit Test of Learning Aptitude

Adjunct Areas of Assessment

- Word Retrieval
- Memory
 - Related
 - Unrelated
- Auditory Memory: Related & Unrelated
 - ITPA: Auditory Sequential Memory
 - ACLC
 - TOLD, CELF – Sentence Imitation/Repetition
- Word Retrieval
 - Test of Word Finding
 - Informal

Types of LP Procedures

- Auditory input
- Subtest complexity
- Discrete language skills
- Increase processing demand
- Multimodality tertiary integration skills

SUMMARY COMMENTS

- Auditory/acoustic processing occurs before you “know” the target
- Auditory processing is “adult-like” by early teens
- Impaired auditory processing can affect language
- Language develops in hierarchy of cognitive complexity
- Language progresses from concrete functional to more abstract
- Language processing is imposed ‘on top of’ basic language foundation
- Language processing continues to develop and refine throughout life

Case Examples

Cassie C.A.= 8.8

Referral: poor short term memory; strong functional & visual memory; history of MEE, no tubes.

Test	Age Eq	Percent	Stand Sc
LPT	7-9	27	90
TOPS	7-8	31	95
TWF	Fast & Accurate	80	112
ITPA			Scaled
Sound Bl	2-4		15
Aud Clos	6-9		29
Seq Mem	7-7		33

- *Low-pass Filtered Speech*: below nrml each ear
- *Time Compressed Speech*: below nrml each ear
- *Dichotic Digits Test*: normal each ear
- *SSW Test*: below normal each ear
- *Competing Sentences Test*: normal each ear
- *Pitch Patterns Sequencing*: normal each ear

- difficulty on degraded speech tasks taxing auditory closure
- greater difficulty on linguistically loaded dichotic task (SSW) with normal scores for digits task
- good labelling of tonal patterns

Auditory Decoding Deficit

Caleb, 10 years

- School testing indicated auditory processing disorder with difficulty following multi-step directions
- Poor performance on CELF and TAPS
- Student “doesn’t get stuff”
- Receiving SL services
- *Low-pass filtered speech*: NU #6 lists: below normal each ear, NU-CHIPS lists: normal each ear
- *Time compressed speech*: normal each ear
- *Dichotic Digits*: normal each ear
- *SSW Test*: below normal each ear
- *Competing Sentences*: below normal each ear
- *Pitch Patterns Sequencing*: normal labelling

Test	Age Eq	Percent	Stand Sc
LPT	7-8	24	85
TOPS	7-10	28	92
TWF	Slow & Accurate	56	102
ITPA			Scaled
Sound Bl	Above		43
Aud Clos	8-3		35
Seq Mem	Above		42

- difficulty on linguistically loaded dichotic tasks (SSW, CST) AND performance difference for filtered words depending upon wordlist used BUT
- NO evidence of primary auditory dysfunction – results consistent with likely language processing deficit – CAPD profile - 2ndary profile

Associative deficit

Rachel, 9yrs-4mos

- Referred by neuropsychologist due to failure to thrive academically
- Average intellectual potential
- Grade at time of test: 2.5
 - WIAT reading level: 1.4
 - WIAT written language: 1.8
 - WIAT spelling: 1.7
 - WIAT math: 2.5
 - Phonological segmentation and word finding issues

- *Low-Pass Filtered Speech*: normal each ear
- *Time compressed Speech*: normal each ear
- *Dichotic Digits Test*: normal RE, abnormal LE
- *SSW Test*: NOE= normal RE, abnormal LE
- *Competing Sentences Test*: normal RE, abnormal LE
- *Pitch Patterns Sequencing*: abnormal labelling, normal mimicking
 - excessive LE suppression on dichotic listening
 - difficulty labeling tonal patterns, normal mimicking

Referral: Failure to thrive in educational setting; repeated kindergarten; currently in 2nd grade. Taking Concerta. Slow to respond in testing.

Test	Age Eq	Percent	Stand Sc
LPT	7-6	5	70
TOPS	6-1	2	56
TWF	Slow & Inaccurate	Below 2	Below 70
ITPA			Scaled
Sound Bl	3-8		21
Aud Clos	4-6		15
Seq Mem	4-10		27

Integration Deficit

Caroline, 12 yrs-2mos

- New to district – previous CAP report indicated dx of CAPD based upon poor SSW and speech-in-noise scores
- Fast ForWord and ALD had been recommended
- District requested reeval prior to new IEP
- Reported difficulty sustaining attention during social conversations
- SL eval done by private SLP – not available at this testing
- ADD diagnosed at age 10
- *Low-pass filtered speech*: below RE, normal LE
- *Time compressed w/reverb*: normal each ear
- *Dichotic Digits*: normal each ear
- *SSW Test*: normal each ear
- *Competing Sentences Test*: normal each ear
- *Pitch Patterns Sequencing*: normal labeling
- only poor score is LPFS – RE
- no pattern of auditory processing dysfunction
- reported difficulty in conversations related to a possible language or reported attention problem

NOT CAPD

Test	Standard Score	Percentile Rank	Age Equivalency
PPVT	128	97	22+
CASL - total	91	27	
- Antonyms	116	86	14.9
- Gram. morph	92	30	10-8
- Sentence comp	98	45	10-8
- Nonliteral lang	93	32	10-10
- Pragmatic judge	72 *	3	7-8
- Ambiguous sent	75 *	5	7-6
- Inference	81 *	10	9-0
OWLS- Written Expression	93	32	10-3

- Communication profile consistent with Asperger Syndrome

Intervention for Auditory Processing Disorders

- **Management:** the environmental modifications and compensatory strategies that are put in place to *minimize* the adverse effects of the deficit
- **Remediation:** *improves* auditory skills AND teaches compensatory strategies
- When choosing treatment program, consider
 - Reported efficacy of program for specific populations – Does it work?
 - Program’s neuroscientific foundations – Should it work?
 - Appropriateness for type of deficit identified – Does it fit?
- Auditory skills training: *bottom-up* therapy
 - based on plasticity theory
 - stimulus-driven, adaptive, repetitive
- Teaching strategies: *top-down* therapy
 - based on neurocognitive theory
 - concept-driven, use metacognitive and metalinguistic strategies
- Acoustic Emphasis
 - Basic auditory skills training, including rhythm training
 - Phoneme Training Program by Sloan
 - Fast ForWord Program by Tallal et. al.

- Dichotic listening training
- Auditory integration training – Tx listening
- Temporal resolution
- Localization training

➤ Phonemic/phonetic Emphasis

- Earobics – both levels
- LiPS program
- Phonemic Synthesis Training
- Rhyming training
- Lipreading / speechreading training
- Diadochokinetics
- BrainTrain

➤ Linguistic Emphasis

- Lipreading / speechreading training
- Auditory closure
 - Discourse cohesion devices
 - Schema induction
 - Context-derived vocabulary building
- Meta-memory strategies
 - Reauditorization
 - Verbal rehearsal
 - Visual imagery
 - Chunking
 - Transformation
 - Mnemonic elaboration

➤ Executive Function Emphasis

- Auditory vigilance training
- Interhemispheric transfer training
- Noise tolerance training
- Prosody training
- Active listening Strategies
 - Self-monitoring
 - Assertiveness training and self-advocacy

Acoustic Processing – Modifications and Strategies

- Gain visual attention before beginning to present verbal directions
- Position yourself in good light and facing the student
- Eliminate/reduce distracting background noise
- Direct signal enhancement via assistive technology
- Use Clear Speech
- It's all about improving access to acoustic signal

Phonemic Processing – Modifications & Strategies

- Use visual phonics or gestures to represent various auditory sounds
- Play games using visual-motor actions to represent auditory sounds or segments
- Play detective to analyze and segment sound aspects of words
- It's about structure and quantity of incoming information

Linguistic Processing – Modifications & Strategies

- Repetition, rehearsal, restatement, and confirmation of auditory information
- Provide clear, succinct verbal directions
 - Use clear language
- Supplement verbal with visual stimuli
- Play compare contrast games with visual-motor to supplement auditory input
- Use visual cues or prompts for ‘listen’ and ‘do’ to promote careful listening before initiating a task
- It’s all about linguistic clarity

Executive Functions – Modifications & Strategies

- Physical, visual organization in environment
- Use pictures, symbols, words for task sequence/analysis to identify the steps
- Use checklists, chore logs, routines
- Generate a plan of steps BEFORE beginning task
- Role play and practice interactions in various situations
- Prepare student for transitions and distractions

Language Processing Treatment Principles

- Work from multiple modality to one
 - Motor, visual, verbal
 - Visual, verbal
 - Verbal only
- Develop competency in language skill, not one specific task

Language Processing Remediation

- Determine level of language processing development
- Begin at earliest level of difficulty
- Use entire second functional unit to approach intervention
- Order language goals in cognitive complexity hierarchy
- Start with discrete – work toward integrated
- Think “hierarchy” – Impose level of language difficulty
- Use neuropsychological model to guide goals
- Use compensatory cues & strategies
- Examine therapy materials carefully

Integrating assessment results and intervention strategies

Cassie – modifications and compensations

Acoustic (bottom-up) emphasis

- preferential classroom seating
- noise abatement at school & home
- direct signal enhancement via FM system
- repetition of info with Clear Speech

Phonemic/Linguistic/Exec (top-down) emphasis

- American Sign Language for 2nd language req.
- adjusted schedule to minimize auditory overload
- preteaching new info, especially vocabulary
- multisensory environ –supplement verbal info with written/graphic cues

Cassie – direct remediation

Bottom-up emphasis

- Temporal discrimination training – Fast ForWord
- Frequency (minimal pairs) discrim training

Top-down emphasis

- Noise tolerance training
- Lipreading/ speechreading training
- Auditory closure activities
- Attribution and self-advocacy training

Recommended Games/Activities

- Earobics for children (both levels)
- Rhyming, A Rhyme in Time
- Wheel of Fortune
- Sound blending games
- Read my lips

Caleb

➤ Language processing profile

- Secondary Zone – build discrete skills
- Tertiary Zone – integration, problem solving
- Word retrieval – maintain accuracy, work on speed

Rachel

- Primary zone weak
- Secondary zone – better at discrete language tasks
- Tertiary – integration poor
- Memory poor
- Retrieval – slow and inaccurate

- Compensate for memory and retrieval
- Make sure signal redundant and clear
- Build language foundation
- Work multi-modality to strengthen integration
- Work on functional integrated language tasks

Rachel - Recommended modifications & compensations

Bottom-up emphasis

- look *or* listen
- repeat with cue, demonstration, model
- present information sequentially
- music while studying
- use Clear Speech

Top-down emphasis

- told task demands “up front”
- preteach
- untimed/extended time tests & assignments
- test answers in test booklet not computer- scored sheet

- notetaker
- books on tape, study guides, Cliff's Notes

Recommended remediation activities

- Dichotic listening training – acoustic emphasis
- Interhemispheric transfer training exercises
- Verbal rehearsal
- Schema induction
- Attribution and self advocacy training

Recommended games/activities

- Name that tune
- Feely bag
- Twister
- UpWords
- Rummikub
- Bopit, Brain Warp, Simon
- Gymnastics
- Piano lessons

Caroline

➤ Communication profile consistent with Asperger – Executive Function Deficits

➤ *Intervention Suggestions:*

- Social pragmatic
 - Nonverbal cues
 - Discourse
 - Situational strategies
- Problem-solving / reasoning
- Fine motor compensation
- Routines
- Sensory breaks/ movement/exercise during school day
- Classroom modifications to insure comprehension

Summary Treatment Comments

- CAPD – starts auditory only
- LP – starts multiple modality

- CAPD – emphasis on acoustic signal
- LP – emphasis on comprehension

- CAPD – bottom-up approach to treatment
- LP – top-down approach to treatment

Thirty great games/books to enhance auditory processing and related skills

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Game	auditory processing or related skill(s)
A Rhyme in Time [®]	speech sound discrimination, auditory closure
Battleship [®]	active listening, visual patterning, integration
Blind Man's Bluff	localization, binaural interaction
Boggle [®]	pattern recognition, integration
Bopit [®] , Bopit Extreme [®]	integration, vigilance
Brain Warp [®]	vigilance, integration, problem-solving
Card games (e.g., Rummy)	pattern recognition, sequencing
Catch Phrase [®]	integration, vocabulary development, output
Clever Endeavour [®]	metalinguistic strategies, critical listening
Feely Bag	interhemispheric communication
Hanna's last-sound game ²	auditory discrimination
Mad Gab [®]	temporal patterning, metalinguistic skills
Marco Polo	localization, binaural interaction
Musical Chairs (also Cake Walks)	vigilance
Name that tune	interhemispheric transfer of function
Password [®]	vocabulary building, metalinguistic skills
Plexers [®]	metalinguistic strategies
Rags to Riches*	metalinguistic skills (idioms)
Read My Lips [®]	lipreading/speechreading
Red Light- Green Light	vigilance, active listening
Rummikub [®]	patterning, problem solving, integration
Scattergories [®]	vocabulary building, metalinguistic strategies
Scrabble [®]	integration, linguistic skills, visual patterning
Simon [®]	auditory-visual patterning
Simon Says	vigilance, active listening
Taboo [®]	vocabulary building, metalinguistic strategies
Telephone game	attention, active listening, discrimination
Twister [®]	integration, critical listening
UpWords [®]	integration, visual patterning
Wheel of Fortune [®]	auditory closure

Processing Differential Levels	Behavioral Objective / Goal	Example Assessment Tasks	Example Intervention Tasks
Acoustic (AUD)	Receiving the signal – intact transmission	* Word Repetition * Tone Discrimination (high- low sequences) * Pattern Repetition (clapping patterns)	* FM System * Preferential Seating * Lip Reading * Tape Recording * Figure Ground
Phonetic/ Phonemic (AUD & SLP)	Analyzing the signal – discrimination of acoustic segments	* Word segmentation * Rhyming * Sound Discrimination	* Sound Blending * Word Analysis (first, middle, last sound) * Grapheme-phoneme Correspondence
Linguistic (SLP)	Understanding the signal – attaching meaning	* Identifying objects * Identifying concepts * Semantic Relationships (synonym, antonym, homonym)	* Concept Development * Word/Object Association * Answering wh questions * Compare/Contrast Tasks
Executive Functions	Managing and organizing a response to the signal	* Pragmatic language * Problem solving/reasoning * Prosodic Interpretation	* Role play pragmatic situations * Work on impulse control * Judgment and interpretation

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