



2009 Summer Conference Handout

Session Title: Model for a Processing Continuum

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Model for a Processing Continuum

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Introduction to Processing

Historical Perspective

- 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
- 1973 – Rees – “The view from Procrustes’ bed
- 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

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 MODELS

Continuum of Processing

X _____ X

Acoustic Processing
Audiologist

Phonemic Processing
Transition of A/SLP

Linguistic Processing
Speech-Language Pathologist

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 Nervous System

- 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
- Dichotic listening – interaction between the two HEMISPHERES

Neuropsychology

Science of understanding how behaviors are related to brain function

- All behavior mediated by CNS
- CNS composed of brain, brainstem, and spinal cord
- Impairment in CNS will interfere with learning process
- Brain dysfunctional = interference in behavior
- neurological model of diagnosis more objective
- intervention only as effective as diagnosis
- need to understand interference to remediate

A.R. LURIA

Functional Organization of the Brain

- Brain structures all play highly specific role & all under coordinated control
- Every mental activity affected through joint activity of discrete cortical systems
- When one system fails, behavior fails – but other parts secondarily resume that function
behavior returns in limited way
- localization in diagnosis remediation
- individual differences as opposed to labels

FIRST FUNCTIONAL UNIT = RETICULAR FORMATION

- Neurological readiness to interact with environment
- Energy system for cortex
- Brainstem = midbrain, pons, medulla oblongata
- Maintain attentive state to incoming signals
- Awakens brain; keeps it alert; directs neural traffic

SECOND FUNCTIONAL UNIT = PARIETAL, OCCIPITAL, TEMPORAL LOBES

- Isolate neural impulses into discrete areas for analysis, storage, coding, organization
- Visual stimuli = Occipital
- Tactile stimuli = Parietal
- Auditory stimuli = Temporal
- Each cortical section further delineated into three zones

THIRD FUNCTIONAL UNIT = FRONTAL LOBES

- Active response through motoric expression to stimuli processed in second functional unit
- Planning, managing person’s behavior in relation to perceptions and knowledge – through motor response

PRIMARY ZONE

- Reception of incoming neural impulses
- Visual stimuli = Occipital
- Tactile stimuli = Parietal
- Auditory stimuli = Temporal
- Not involved in interpretation of meaningfulness of stimuli; only sensation
- Impairment = sensory impairment; not higher order processing

SECONDARY ZONE

- Process incoming information and attach meaning to input received
- Visual meaning = Occipital
- Tactile meaning = Parietal
- Auditory meaning = Temporal
- Interpretation through coding, organizing, associating, storing
- Integrate into meaningful experiences

TERTIARY ZONE

- Multisensory neural integration between sensory secondary zones
- integrate newly organized stimuli with stored information
- integrate discrete neural impulses between modality areas
- Coordinate higher level processing
- integrate information from all cortices
- transfer passive receptive input into active expressive output

MODEL CONCLUSIONS

- Model supports hierarchical integration of processing following neuromaturational order of zones
- zones develop maturationally in order – primary, secondary, tertiary
- tertiary zone last to mature and most fragile
- Progressive attachment of meaning to stimuli supports contribution of each level in hierarchy
- Concept integrates entire nervous system in thinking process

SLPS and AUDs are primarily interested in activity of Second Functional Unit – Left Temporal Lobe

PREMISE OF USING NEUROPSYCHOLOGICAL MODEL FOR EVALUATION

- Behavior is function of CNS activity
- Assuming CNS functions systematically AND dysfunctions systematically – possible to measure skills in children which reflect systematic CNS patterns
- Selected subtests can be used to sample subset of behaviors reflecting CNS function
- Deficits in particular skills should be demonstrated on more than one subtest

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

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

Intervention for Auditory Processing Disorders

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

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 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
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- Preliteracy foundation
 - Sound-symbol correspondence
 - Spelling
 - Reading
 - Written Language

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

Language /Linguistic Processing

- Labeling
 - Stating Functions
 - Association
 - Categorization
 - Antonyms
 - Synonyms
 - Idioms
 - Analogies
 - Multiple Meanings
 - Stating Attributes
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- Language Foundation for metalinguistic skills
 - Ability to comprehend and express ideas through auditory to verbal modality
 - Conceptual basis for higher level, more complex language

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

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

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

Teacher Strategies

- Introduce information using multi-modality approach for sensory stimulation
- Supplement auditory info w/ visual materials
- Introduce new material in context-rich associative environment
- Provide cues, prompts, hints to help focus student and facilitate retrieval
- Allow “thinking time” and monitor external pressure when latencies occur
- Limit timed activities and performance tasks; provide extra time
- Vary type of responses expected on exams and class discussion
- Shorten length of assignments to promote focus on accuracy rather than efficiency
- Refresh stimuli with repetition, re-phrasing, and expansion clarifications
- Teach with stories and examples to associate main points of auditory information

Student Strategies

- Request additional time when needed
- Request cues, prompts, associative info
- Ask specific questions rather than generic
- Apply strategies taught in therapy that work to facilitate retrieval

- Learn to state what you know, then the source of confusion
- Tape record to provide repetition or permanent record of lecture
- Learn to use rehearsal, paraphrasing, and writing key words to keep processing on track
- Be an active learner, rather than passive
- Be patient; take your time and don't give up or become frustrated
- Seek out study buddies to check information

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

Dr. Jeanane Ferre, Ph.D., CCC-A

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

Resources

- American Speech-Language-Hearing Association (2005). Technical Report from the Working Group on (Central) Auditory Processing Disorders. ASHA: Author.
- Bellis, T.J. (2002). *When the brain can't hear*. NY,NY: Pocket Books.
- Ferre, J. M. (1997). *Processing Power: A Guide to CAPD Assessment and Management*. San Antonio, TX: The Psychological Corporation.
- Ferre, J.M. (2002). Managing children's central auditory processing deficits in the real world: What teachers and parents want to know. *Seminars in Hearing*, 23(4):319-26.
- Richard, G. & Ferre, J. (2006). *Differential screening test for processing*. . East Moline, IL: LinguiSystems.
- Richard, G. (2000). *The Source for auditory-language processing disorders*. East Moline, IL: LinguiSystems.
- Richard, G. and Fahy, J. ((2006). *The Source for development of executive functions*. East Moline, IL: LinguiSystems.
- Richard, G. & Hanner, M.(2005). *The Language Processing Test-3*. East Moline, IL: LinguiSystems.