

# Listening and Learning

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## The role of auditory function in learning

Almost every developmental label today from ADD/ADHD to autism and Down Syndrome has some challenges with auditory function. The determination of symptomatic labels for learning disorders does nothing to help that person function in a more effective way. When a person has a challenge listening and learning, and there are problems that are causing this, and the causes are not addressed, the symptoms will persist. In order to achieve proficiency with normal listening and learning function there are certain developmental steps that are attained by every human.

The auditory nerve develops at about 8 weeks of gestation in the developing fetus and produces an adult size cochlea about 4 months before birth. This makes auditory function the first of the five senses to begin significant development and also makes hearing a primary cornerstone for learning, for relating to the environment, and for decision making. After birth, the next two formative years of children's brain development are critical for normal emergence of hearing, thought processing, and learning abilities.

Most learning takes place through hearing and seeing. When there are distortions of any kind in these functions there will always be deviations in development that ultimately manifest in learning and behavior dysfunctions ending ultimately, in developmental labels. If the quality of the hearing is bad or the process of hearing in the brain is disorganized, then the rest of the functions that depend on hearing are affected.

Social behaviors and sound social decisions are founded in auditory processing skills. There is no sonogram, x-ray, MRI or any passive detection devices that can measure hearing development or abilities in the brain. In order to assess the quality of the auditory input and processing abilities we look at the output functions of the brain that depend on the hearing. Some of these functions are speech, behavior, emotional maturity, thought processing, learning abilities and the ability to relate to the environment.

For example, one of the major components of speech is hearing. If the hearing is distorted, speech can be delayed and impaired and the tone of the voice may be monotone or the voice level too loud or soft. Behavior changes in noisy environments can indicate a problem discerning threatening sounds from non-threatening ones or hypersensitivity of hearing. A low auditory processing individual will act at a lower age level to what is normal. Disorganization in story telling sequences, following instructions, and poor learning abilities relate to hearing processing abilities. A diagnosis of Autism or PDD (pervasive development disorder) usually encompasses an extreme environmental sound sensitivity that causes sensory integration challenges relating to the environmental sounds.

In auditory functions, which are the building blocks of learning, there are many causes of distortions that affect the development of the child like ear infections, allergies, vaccine insults, traumatic brain injuries, diet, and sensory deprivation to name a few. Something as simple as the angle and position of a nursing infant can affect hearing development Otitis Media, (ear infections) and sinus congestion are some big culprits that cause auditory mal-development early in child development. If there is a history of ear infections, tubes and sinus problems with a child, there are invariably distortions in auditory function that cause deviations in the learning process.

The child will often manifest a normal audiogram which show hearing thresholds, but when we look at the quality of the hearing and the ability to process sounds and to learn from auditory input, we find distortions. This means that the child may hear sounds but does not hear them clearly. Often there will be problems distinguishing one sound in a background of noises and other sounds. This child that may be able to pay attention normally in a quiet environment, but in

a noisy environment like a classroom or other public place, both the ability to discriminate sounds and behavior falls apart.

Another area of auditory function is long-term memory. This is the brain's ability to hear, process, store, and retrieve information. Long term memory is established and maintained in hemispheric dominance of the brain's cerebral cortices. Memory function requires good clean input of information, processing and storage with the correct centers and hemispheres of the brain, and retrieval of the same information in the proper sequence that it was first put in with. A lack of a dominant hemisphere for storage and retrieval causes reversals in information output, stuttering, and long term memory problems.

Listening skills is an auditory process that requires good, clear tonal processing. But even listening is impaired when the sounds are not perfectly clear. There can be certain frequencies at which a person processes very little information because the tonal processing is impaired and distorted. For some there are frequencies at which the sounds can't be distinguished in a noisy background and everything becomes a constant din rather than distinguishable sounds. There can be frequencies at which the individual is too sensitive to sounds and the brain shuts down and ignores the sounds, There are frequencies in some people at which the hearing is normal or superior across the frequencies, but with extreme distortions.

There is a specific center of the brain responsible to catalog every sound that is ever heard by the ear. The brain takes these sounds and indelibly catalogs sounds with events, things, people, pain, pleasure, threats, emotions and etc. If there is an undistinguishable sound the brain rushes through the memory banks looking for similar sounds and circumstances to relate the sound to. In the event that the brain cannot specifically identify the sound it could stretch, re-invent, and fit the sound into a familiar category that may or may not be appropriate i.e. hearing voices, panicking at non-threatening sounds, or allowing the individual to pet the snarling dog. The brain may also choose to ignore the sound as hopelessly indiscernible and shut it out, or it may put in a new file awaiting more information to catalog the sound with.

The brain starts to learn to hear and catalog sounds from before birth. The startle reflex is present at birth in an infant and develops normally by experiencing sounds and relating them to threats or non-threats at first. As the brain centers acquire more sounds and figures out what is not going to eat the child, the startle reflex becomes mature and appropriate. All this is done by hearing sounds in the environment and wiring them in the brain to the appropriate centers thereby eliciting appropriate responses. Higher pitched sounds in music that are high quality and highly organized activates the brain for efficiency while the banal and lower sounds in music that are of low quality and organization (like rap and some rock music) clutters, deactivates and disorganizes the brain.

Phonics is an auditory process that requires three essential components. The first is the elementary input of clear sounds that can be recorded in the brain and mimicked with the mouth, sinuses, and vocal cords. In order to properly mimic the sounds the child absolutely has to hear the sounds made by the model and the sounds made by itself. The second component is auditory processing abilities as discussed in chapter two. Phonetic concepts cannot be understood and adhered to without a maturation of sequential processing abilities. The third component is visual models of face and lips and tongue making the sounds to mimic. Again, clean visual input is required to have clean output of phonetic enunciations.

The hearing process catalogs over ten octaves of sounds as compared to sight which takes in an equivalent one octave comparatively, this makes hearing 10 times more dynamic than sight to brain processes. This is why a blind person typically adjusts better to the environment and fairs better in life than does a deaf person. Hearing is so important that hearing quality affects the moods and behaviors and well-being of the individual. Hearing is intimately integrated with and directly affects the whole central nervous system.

The extreme of hearing problems and sound distortion is usually found with the child that is labeled in the autistic spectrum. To the autistic child most sounds are a muddled roar like trying to listen to 3 or 4 radio shows superimposed and playing all at once. Indiscernible sounds become unsettling and even threatening to the autistic child when one sound cannot be isolated and discerned from other sounds. Many of these children cannot develop expressive language because of the limited input of clear information that becomes the foundation for language. Autistic children often develop what is called sensory play that either stimulates the brain with endorphins or literally drowns out the confusing roar of garbled auditory input. Autistic children will often make weird sounds, scream incessantly, and bang on things, drowning out noises with TVs loud music, etc. because of perverted auditory signals.

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*There is also speculation that hearing quality affects the moods and behavior of the individual.  
Dr. Tomatis, the pioneer French ENT*