Keep Your Ear-Lids Open

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Being able to perceive visual and aural stimuli are natural capabilities most humans have at birth. However, the ability to derive meaning from these stimuli is a learned process beginning with infancy and continuing throughout one's lifetime.

The infant first learns to give attention to specific visual objects and sounds which are vital to personal survival. Shapes, colors, patterns, pitch, rhythm, and timbre are initially associated with parental support and protection. Eventually, the child's aural and visual interpretive skills become more proficient and the world begins to take on form and definition.

Schooling provides formalized sensory training in the use of visual and aural skills as they specifically relate to language and speech development. A child learns to read text, and to hear and interpret the spoken word.

A general observation suggests that teachers give proportionally more time to the development of verbal communication than they do to facilitating a child's visual and aural literacy skills. Few educators encourage children to develop the ability to effectively see and hear the multi-sensory world beyond text. Those programs that do extend sensory training focus primarily on the visual sense as evidenced in the literature of the visual and media literacy movements. Unfortunately, listening is given little attention by educators. When addresses, instruction is limited to the area of speech communication.

Educators need to realize that children live in an ever increasingly multi-sensory world. Not only are they exposed to motion pictures, television, multi-media, advertising, radio, and audio, but also complex natural and human made environments.

Those of us who practice in the field of visual and media literacy must be able to give attention to all sensory input if we are to fully enhance our student's abilities to live and work in a world of sight and sound as well as text. Aural and visual literacy are two areas of interrelated study that should be addressed by educators.

Listening

Human audition involves the perception of hundreds of thousands of bits of information received each second. Since one doesn't have ear-lids one continues to hear sound even when asleep (Schwartz, 1973).

Sounds and words are acoustical patterns that one learns to recognize and which become a part of one's cognitive knowledge of the world, one's feelings, and one's mental imagery. The mind compares new auditory information with previous experiences. When an acoustical pattern matches remembered aural events, the listener may recognize the voice of a friend, a favorite pet, or familiar sounds of home, school, and work.

The first sound a child hears is probably that of a mother's heart beat. This rhythmical pattern provides reassurance and security. Later a mother's words are emotionally comforting even though the new born has no initial cognitive perception of the verbal meaning.

As an infant develops, attention and response is given to more intricate sound patterns. Volume, rhythm, and pitch facilitate personal identity with a temporal aural world. Children come to recognize that the sounds of the family dog, the arrival home of a parent after work, and that of nature's stormy weather, all have specific aural meaning.

Eventually language becomes a principle tool in learning to be a problem solving individual. Learning how to be an effective listener is central to becoming a good learner. Elementary and secondary students, for example, spend 50% of their time listening to teachers and others. This increases to 90% when young adults enter college. Listening skills are essential when learning is guided by the spoken word; main ideas, details, or influences are orally presented; and when a student must analyze the structure of a lecture or distinguish between relevant and irrelevant information (Heinich, 1993).

Hearing and listening are not the same. Some of the best hearers are the worst listeners (Stocker, 1973). Listening requires a quantity of mental effort. A sound, being temporal, must be remembered long enough to be assimilated and interpreted. Natural sounds and spoken words quickly decay once generated. The listener, for example, must mentally retain each word until a sentence is completely stated. Only then can an interpretation be made.

Active listening involves the ability to discriminate between sounds within a multi-pattern context. One hears aural information placed against a background field of constant noise. A child at a playground can discriminate between any number of background conversations or situations, or be immediately cued-in to the mention of his or her own name.

Listening and seeing, as mentioned earlier, are learned skills which are enhanced through instruction and practice. Most classroom listening programs facilitate the development of verbal interpretation and comprehension skills. Students learn how to retain and summarize what others say, and to answer questions that test their oral memory. Such programs try to unteach multi-pattern listening. But, by emphasizing the verbal context in speech, we deny children the opportunity to explore the richness of non-speech sounds (Schwartz, 1973).

Teaching children how to interpret, and deduce meaning from oral communication should be balanced with enhancing their ability to listen to, and understand, the environmental soundscape in which they live. Giving attention to non-speech sound will enrich individual appreciation of all sound and facilitates the contextualization of the spoken word as part of a broader aural world.

Developing effective listening skills requires an understanding of how sound is attended to by the human mind, and the type of information gathered through listening to non-verbal sounds.

The Soundscape.

Any soundscape has three layers, or planes, of acoustical information. (Schwartz, 1973). The first is that of foreground sound, or that sound which gets one's prompt attention. A noise, such as a fire siren, may reside as a background sound until one smells smoke. The association between smoke and the siren brings the siren screaming forward into the listeners consciousness with special significance.

Contextual sounds are those taking place in the vicinity of the foreground sound. Given the sound of the fire siren, one may also hear related sounds such as shouting, crackling fire, and the chaos of great commotion. This additional layer of sound supports and makes more urgent the message being presented by the siren.

The background field is the ambient soundscape against which the first two sound planes are contrasted. Given the previous fire scene, there are other sounds forming a background against which the principle events take place. These sounds may be unrelated traffic noise, a cathedral bell, aircraft landing at a local airport, or other acoustical events of an urban environment. In a rural setting, the background field may be the sound of a flowing stream, wind in a row of trees, birds, or other sounds having no immediate relationship to the principle sound event but are never the less present.

Aural Processing.

Though there are many listening models, one that is appropriate for our purposes suggest seven listening actions which take place in the processing and decoding of aural information (Fessenden, 1955). These events happen within milliseconds of each other and may not always be followed in this specific order.

Isolation. First, attention is given to a specific sound which is isolated from the thousands being heard. The sound may be short and over quickly. Other sounds may be long and sustained. Some sounds begin with a clear attack and then fade away smoothly. Other sounds rapidly reiterate and form a trembling effect such as the roll of a kettle drum (Dwyer, 1976). Whatever the sound's attributes, the brain isolates it from an acoustical field and has given it immediate attention.

Identification.

The listener compares the acoustical pattern of the isolated sound with sounds she or he has experienced in the past. An association and identification is made.

Integration.

The sound, now identified, is placed into context with other supportive sounds which facilitate the integration process. The listener recalls similar situations in which this sound has been heard before.

Inspection.

The sound is given additional inspection as the listener examines its tonal color or timbre, the highness or lowness of its pitch, and the loudness of volume. This inspection provides additional information such as possible emotional stress in the barking of a dog, or the crying of a child.

Interpretation.

Upon further inspection the subtle implications of a sound are noted. It has now become representational of an actual event which is heard but not necessarily seen. Here, not only the support sounds but the background field facilitate the interpretation process. The listener matches the sound pattern with past experiences and makes an interpretation giving the sound specific context and meaning. In the case of the barking dog, the listener may assume that a stranger has entered the yard. Or, that the crying of a child may be the result of a

sibling squabble.

Interpolation.

Missing components are "filled-in" by the listener to give fuller meaning. Given that a stranger has entered the yard the listener realizes that the expected repair person has arrived. The siblings, based on the listener's past experience, will soon be running in to blame one another for the commotion.

Introspection.

Having identified the sound, context, and expectations, the listener determines whether a personal response is needed and acts accordingly.

The ability to interpret sound results from both formal and informal learning. Informal in the sense that we all learn by experience to interpret sound. Formal, in that good listening skills result from intelligent, conscious practice (Thompson, 1969).

Aural Information.

There are five categories of information which can be obtained from listening to non-verbal sounds. These are: physical activities, invisible structures, dynamic changes, abnormal structures, and events in the world (Loge, 1993) (Laurel, 1992).

Since hearing is the perception of pressure waves within the atmosphere, any physical activity that disturbs the air will generate sound. The rush of a passing train, the blowing wind, or the subtle rustle of leaves, provides the listener with information about specific physical events.

Sound also provides information about invisible structures. A carpenter will tap on a wall to locate hidden supportive studs. A fishermen uses an echolocation finder to help seek out schools of fish. A blind person may interpret the layout of a backyard garden by listening to the sound rain makes as it falls on different types of shrubbery and vegetation (Hull, 1992).

Dynamic change is a third area. The acceleration of a jet engine on take-off provides volumes of information to a pilot's trained ear. A carpenter, using an electrical saw, judges the cutting process by listening to the sound of the whining blade.

Sound provides information about abnormal structures. The doctor listens to the human body and is able to diagnose a heart murmur, pneumonia, or other internal problems from the aural data he hears. The mechanic is able to analyze the status of an operating engine by the sound it makes. She doesn't need to see the firing pistons to determine the nature of a specific engine problem.

The ability to analyze an auditory scene can provide much needed information about events in space. The essential feature of sound is not its location, but that it fills space (McLuhan/Carpenter, 1960). This auditory space is three-dimensional and surrounds the listener. Fortunately, human hearing is designed to function exceedingly well within such an environment. So, the fifth type of information sound provides is that of events happening within the context of a three dimensional soundscape.

A listener sitting in a chair, for example, can detect the approach of a person from behind. Or, while walking along a sidewalk, one can estimate the movement and direction of adjacent vehicles. Additional sound events would include alarms, bells, buzzers, and other aural signals

that provide information about external events to which immediate attention must be given.

This aural cueing is very effective in providing the listener with information about the unseen world. The listener hears certain sounds and knows what is happening without the need to see the actual event. The sound of sirens, church bells, a neighbors stereo, the way a person sighs, a friend's walk, are all examples of cueing through sound.

Ear Tuning Exercises

A student's problem, according to Tony Schwartz, is not an inability to listen, but a failure to attend to sounds being heard. Auditory perception can be enhanced through practice. There are numerous approaches one could take to the development of listening skills. The term "ear tuning" (Schaffer, 1977) seems an appropriate way of thinking about ear training. The following three areas of exploration, will encourage students to give attention to the non-verbal soundscape within which human communication takes place.

Students are encouraged to use a tape recorder to capture the sounds in each activity for further detailed examination. Any tape recorder will work but the quality of the recording will directly correspond with the quality of the equipment used and the expertise of the student making the recording.

Exploring Temporal Relationships

Vision, researchers have noted, is effective in providing knowledge related to spatial distinctions but is relatively poor for suggesting temporal relationships. Audition, on the other hand is quite effective in providing information about the passage of time, rhythm, sequence, and frequency.

All sounds are transitory and cease to exist once generated. This temporal nature of sound requires extensive use of short term memory. This is especially so in verbal communication when the exact meaning of a sentence isn't known until it is completely spoken. But a spoken sentence cannot be held for examination like a photograph. It is only through the use of short term memory that one can retain a sound long enough to give it meaning. Long complex sentences become very demanding of short term memory (Fleming, 1984).

Exploring the temporal qualities of sound may be initiated with students recording a variety of actions and then classifying each by editing them into these categories: (1) sounds that demonstrate the passage of time, (2) sounds that produce frequency and rhythmic patterns, and (3) sounds that form sequences.

Passage of Time.

Illustrating the passing of time can be achieved by recording sounds that fall into at least one or more of the following acoustical actions.

- **Starting/stopping.** Probably the easiest sounds to collect that define time would be those that have a definite start and stop. The sound of an electric drill motor, an elevator moving from floor to floor, or other action which has a definite temporal sound quality.

- **Entrances/ Exits.** The opening or closing of a door is an obvious example of this

action. The sound of an automobile approaching, passing and then fading into the distance, also represents the temporal nature of sound and the passage of time. The movement of a train, an airplane passing by on take-off, or a runner on a track field, are similar examples in which sound defines a transitional frame of reference.

- **Adding/subtracting.** The sound of a liquid being poured into a container would suggest the adding of a substance over a period of time. The opposite action would suggest subtraction.

- **Expanding/contracting.** The sound of blowing-up and deflating a balloon would create the transitional effect of expansion and contraction. The sound of one's own breathing would be a similar acoustical example.

Frequency and Pattern.

Rhythmic sounds are numerous and fun to explore with a tape recorder. The chirping of crickets, the pattern of a flag flapping in the wind, the sound of ones own walking or running, finger snapping, hail against a window, taping of a woodpecker, the flip flop of sandals or clicking of high heels on a hard surface, the sound of a rotary dial telephone, or the operation of machinery are all pattern or rhythmic-based sounds.

Sounds can be collected and then classified as to their metric patterns. Some sounds will have a very definite measured beat such as the sound of rain drops falling from the eves. Other patterns may be irregular such as that generated by wind chimes. This classifying activity will help students learn to discriminate between the unique patterns they hear each day.

Sound Sequences.

John Hull, a blind author, describes an auditory scene he experienced which illustrates the concept of sequenced sound. As Hull sat on a park bench he heard a sontage of events. Children appeared and played joyfully about, footsteps of people walking together approached. Each had a different stride but together they form an interesting rhythmic pattern. This acoustical field then gradually became dominated by the longer strides of a runner who overtook the group and passed. The soundscape continued to change in a sequence of acoustical events which constructed an auditory scene within his mind (Hull, 1992).

Students can create auditory scenes composed of non-verbal sounds. The following illustrates one possible short aural event. A large diesel truck is heard driving down the street and comes to a stop in front of the listener. A driver exits the truck slamming the door behind. The listener hears the clatter of a large empty barrel being removed from its rack followed by footsteps quickly moving up a sidewalk.

The sound of a trash can being opened and its' contents poured into the empty barrel is heard. The barrel is lifted with a grunt and heavy footsteps slowly walk down the sidewalk and back to the truck. The barrel is hoisted with great oral effort and emptied with a thunderous crash into the truck. The grinding sound of gears is heard as the contents are compacted. The driver opens the truck door, slams it shut, and drives off.

This sequence tells a story in sound. The recording of this auditory scene could be done as an actual event happens, or planned and executed with the recordist being placed in the best miking location to pick-up each of the selected sounds.

Exploring Aural Perspective

The sound one perceives is shaped by the environment within which that sound is generated. The sound of a church bell, for example, will be affected by the shape of the valley through which that sound travels (Mathieu, 1991). The sound of a low flying jet is modified by the density of the clouds through which it passes. Occasionally this sound is very rhythmic as the plane fly's through a combination of open sky and clouds of various densities.

A most unusual observation of aural perspective occurred in England. A medical report from Derby, in 1981 noted that a woman, blind since the age of twenty-seven, began to suffer deafness a few years later. She indicated that she could no longer hear the silence of lamp posts. The researchers found this comment interesting and with further investigation discovered that the lady had been able to walk through a forested area and avoid trees, roots, and other vegetation. In addition she could identify the type of vehicle that was close by as to if it were a car, truck, or van (Smith, 1984).

This individual was obviously an exceptional listener. She was able to hear the reflection of sound from solid objects, determine the unique physical characteristics of each, and was able to navigate according to the auditory information she received.

Aural perception of acoustical space has been extensively studied by researchers at NASA-Ames, MIT, and elsewhere over the past twelve years. It has been discovered that the ear is a very unique instrument for receiving and localizing sound within the acoustical envelop that surrounds it. People have a natural ability to isolate sounds in relationship to their approximate positions be those sounds behind, to the side, above, below, or in front of the head. (Wenzel, 1992).

The following activities explore acoustical perspective. Sounds which are far away, close-up, or move in juxtaposition to the listener are investigated.

Distant Sounds.

The source of a distant sound is frequently out of sight and this makes it interesting in that one needs to interpret the action taking place based solely upon the acoustical characteristics one hears.

One might listen to, or record for later use in the classroom, road construction activity located several blocks from the listener. Understanding what is taking place requires one to differentiate between the sound of a road grader, jack hammer, or other tools being used.

The flow of traffic between tall buildings in a large city as heard from a hotel room also provides a challenge. One can eventually distinguish between certain types of utility vehicles, busses, cars, and other vehicles crowding the street below. Of course there are other sounds such as people on the side walks and planes flying overhead that become part of this sontage.

The sound of a distant airport is also interesting in that one can hear planes of a variety of sizes and power landing and taking off. Airplanes, depending upon their movement on the runway generate a diversity of sound effects. One listens and try's to visualize what is happening based upon the variety of sounds heard.

Rural locations offer more opportunity to explore distant sounds in that there is frequently less foreground noise. Children might record voices as heard from high on a hillside. Or, given

the quiet of a lake, one might record the call of a distant loon in the early morning. The goal of this activity is to recognize that our ears bring to us a world of sound that has depth and distance.

Intimate Sounds.

The second listening activity is to discover those sounds which are up-close and often personal. These sounds may be quite ordinarily but are ones to which we may give little attention. These could include: one's own breathing and heart beat, wind blowing around a crack in the window, the movement of leaves across the yard, the shuffling of cards, the sound of combing one's hair or rubbing the skin, the hiss of a stove's pilot light or gas burner, the hum of a refrigerator, the rumble of washing machine, or water flushing in the toilet. Other up-close sounds might include the sound of skies on snow, hum of street lights, or the burning of a log in the fireplace (Mathieu, 1991).

Moving Sound.

Finally, exploring sounds in motion adds to one's awareness of aural perspective. We hear sounds everyday which move across an auditory stage. Although sound is three dimensional it is the sound generated by moving objects, or the movement of the listener in relationship to a sound, that strengthens the perception of three dimesonality.

Standing on a freeway overpass provides one with the opportunity to hear a diversity of moving sound. Each vehicle produces its own unique sound patterns. The sound of a truck grows louder as it approaches and then is quickly diminished as it passes under one. All the freeway sounds together have a unique rhythm and pattern reminiscent of music - though some may disagree with that observation.

Other moving sounds may include a person walking on a side walk outside one's home. A passing freight train through town. The daily morning flight leaving for a distant city that always fly's overhead.

Recording one's observations of moving sounds is best done using a binaural microphone system if available. Upon playback, the sound is reproduced through a set of stereo headphones and gives the illusion of the original 3-dimensional world. The listener has an aural perspective in which sound moves in an acoustical space outside and around the head.

Exploring Effects of Space on Sounds

In his book, *Touching The Stone,* John Hull shares a time after his becoming blind which demonstrates the relationship between the shape of objects and the sounds they reflect. One night he awoke to hear it raining. He was amazed at the variety of sounds this generated. At first there was the rain on the windows, then he noticed the pattering on the roof. He arose from the bed opened the window so he could listened in the rain in the night. He discovered that the falling rain gave form and definition to the vegetation in the yard below and the tree's beyond. The landscape had come alive with the varied patterns and tonal qualities produced by the rain falling against objects of diverse shape, densities, and textures (Hull, 1991).

Hull had discovered that the natural environment was able to reveal something about itself through reflective sounds. Soft surfaces absorb sound waves while hard surfaces reflect. Exploring these dynamics is an activity which students, once again, can effective accomplished

by listening.

Students might begin by discovering the acoustical properties of architectural spaces of home or school. It is suggested that two students work together with one being a recordist and the other speaking a short narrative statement. An alternative would be to have one student sing or play a musical instrument such as a flute or guitar.

The following chart illustrates the expected effects that various spaces will have on the quality of sounds recorded.

HOME	SCHOOL	SURFACES	SOUND CHARACTERISTICS
Kitchen	Classroom	Angled	Lively with reverb
Bathroom	Stairwell	Flat	A lot of echo
Living Room	Lounge	Drapes & Furniture	Soft with little reverberation

Only a home and school site is mapped in the chart above. Other building sites could be investigated and comparisons and contrasts made between the effects various architectural surfaces have on sound.

Natural environments also effect the characteristics of sound. Using the same technique as above, record sound in a variety of outdoor locations. The school playground, a park with lots of trees and shrubs, an open field, a place where one can shout and obtain an echo, are all locations where the shape, texture, and other natural characteristics will effect the sound being reproduced.

Exploring figure ground relationships

The concept of figure and ground relationships is not limited to pictorial stimuli. A spoken word, for example, can be a figure against a background field of automobile noise. A bell can dominate the foreground against the soundscape of a city. A sound may become a figure given its intensity, volume, pitch, rhythm, or especially the attention of the listener (Fleming, 1984). Sound figures can be natural in occurrence or selected by the will of the listener.

Figure and ground relationships can be explored in two ways. The first is to take note of those sounds which physically dominate a soundscape and those which the listener selectively chooses to hear. The discovery of dominate sounds can be logged in a field journal. For example, a student might be asked to record at least ten sound figures that he or she hears during the day which result from a change of volume, pitch, or rhythm. Examples might include: class bell, school marching band, referee's whistle, teachers voice, car horn, stereo, radio, and so on. The student would identify the sound heard as a figure, and then describe the acoustical context or field against which that sound was heard.

A second activity would require students to shift selective focus. For example, a student might listen to a marching band. He or she could first listen to the band as a whole unit and then sift focus to individual instruments. Given attention to the drum - bring it forward and give it emphasis. The clarinet, trombone, or other instruments might be selectively focused upon and

each becomes the dominate sound object to the listener. This is similar to one being able to discriminate between a room full of conversations and selectively listens-in on a specific conversation or is instantly aware of the mention of one's name.

Summary

We have identified the importance of listening to non-verbal sound; Identified one model for the processing of sound events; identified five categories of information which can be obtained from listening to non-verbal sound, and explored four ear tuning exercise that will facilitate the initial development of effective listening.

This initial exploration is far from complete or comprehensive. Little research has been undertaken in the development of listening skills related to non-speech information. Perhaps this article will serve as a stimulus for further discussion.

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