

THE WONDERS OF US
 Making Sense of our Senses -- #3 HEARING
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Bulletin insert: "That is the essence of science: ask an impertinent question, and you are on your way to a pertinent answer."

Jacob Bronowski
Ascent of Man, 1973

OPENING WORDS: Song #313 – Oh What a Piece of Work We Are
 Band Aid on elbow

The Wonders of our World. In a time when we understood less, we named a god Poseidon and credited all the mysteries of the sea to his control. Today, natural wonders still inspire some to see those wonders as God Tracks. We share their awe and cannot prove their celestial connection wrong. And that's OK.

The Wonders of our World – the breadth and depth of them are too much to grasp, to assimilate from all the specialists who devote lifetimes to understanding but small corners of these processes. We can, and some have, built a theology of sorts on this ever evolving, ever changing universe of which our earthly existence is but a small part.

But, possibly, most fun of all is to reduce that universe, universe within universes, until we bring our scope of thoughts down to the universe that is us, you and me. Just look at us, you and me. Each of us a unique but pretty fancy mechanism on our own specific journey.

Let's explore some more Wonders of Us.

I met a World War II veteran in Texas in the winter of 2003 who, I learned, was a retired teacher of drama and history from Iowa. He elaborated that his preference for teaching history was an emphasis on ideas, patterns of reactions of people and governments, and events that changed the direction of civilization. He abhorred rote memorizations of names and dates. His comments on practical, useable history led to my stating that I thought Harry Truman was a good example of one who studied practical history with a passion and applied it rather masterfully in his decision making process. Bob, my new acquaintance, replied with enthusiasm, "Harry Truman is my hero! He saved my life!" Bob explained he was in the Philippines training for the land invasion of Japan's home islands. The total death toll on all sides was projected by MacArthur and others to be in the millions. The Hiroshima and Nagasaki bombs convinced the Japanese to follow a different course.

I have no such experience with war or the threat to my survival from such actions. I guess I could say my father saved my life in that regard – although it's a bit of a stretch. My father built tanks during WWII because the military wouldn't accept his curved spine and poor hearing. Ditto for me on Vietnam.

Thank goodness my hearing, while not up to mil spec, is adequate for me to take and obey orders from our piano player, if not from a uniformed order giver. Thank

goodness because not being able to hear cuts off such an important and valuable link to the world outside ourselves. People who are both deaf and blind often lament the loss of their hearing more than anything else. Helen Keller: “I am just as deaf as I am blind. The problems of deafness are deeper and more complex, if not more important, than those of blindness. Deafness is a much worse misfortune. For it means the loss of the most vital stimulus – the sound of the voice brings language, sets thoughts astir and keeps us in the intellectual company of man.”

If I found a doctor who thought a hearing aid would fix my shortcomings, I’d have one in a minute. I can’t imagine trading vanity for hearing.

The literature of deafness is extraordinarily rich. Writers and thinkers from Herodotus to Guy de Maupassant have written about their own deafness or the deafness of loved ones with poignancy, eloquence, and charm. Consider if we as creatures of this world did not hear. What would be language? Music? Life? What is the biggest wonder? That we do hear? How we hear? or what we have done with our ability to hear?

Hearing begins with sound. First, something has to shake the air molecules around it. They bump into other molecules. Waves of sound roll towards our ears, typically complex waves of various frequencies and amplitudes. The sailor on a sea of sound would recognize a single tone from one direction and, maybe, two tones from two directions. However, the most experienced sailor could make no sense of such a wavy sound sea that typically surrounds us. But we have developed sophisticated equipment to separate, sort, analyze, and interpret the mass of confused wave action – our system of hearing. And it is a system, that, to anyone technically inclined, inspires awe.

The outer ear is more than a funnel, a sound catcher. It is also a complicated reflector, which takes some of the sound and hurls it right down the hole; but a tiny fraction of the sound is reflected off the top, bottom, and side rims of the outer ear and directed into the hole a split second later. As a result, there is a special set of delays, depending on the angle the sound is coming from. We hear some things twice. The brain reads these delays and knows where the sound is coming from. Blind people use their ears to map out the world by tapping with a cane and then listening carefully to the echoes. Other creatures with a greater need for echolocation such as bats and porpoises developed systems to serve their needs.

The waves of sound that go down the hole vibrate the eardrum; this in turn moves the three tiniest bones in the body, which everyone probably had to learn to name as question #9 in high school biology; the hammer, anvil, and stirrup. Although the cavity they sit in is only about a third of an inch wide and a sixth of an inch deep, the air trapped there by blocked Eustachian tubes is what gives Scuba divers and airplane passengers such grief when the air pressure changes.

When the sound waves hit the fanlike eardrum, it moves the first tiny bone whose head fits in a cuplike socket on the second, which then moves the third, which passes like a piston against the soft, fluid-filled inner ear, in which there is a snail-shaped tube called the cochlea, containing hairs that twang the auditory nerve cells. Fluid vibrates, hairs wiggle, nerve cells fire and ----we hear! Of all the senses, hearing resembles a

contraption some ingenious plumber has put together from spare parts. The system grabs pneumatic pressure variations in the air, converts it to mechanical motion which bridges the air/water gap, where the hydraulics tweak and interface converting to an electrical impulse. The vibrations follow a maniacal miniature golf course, with curlicues, branches, roundabouts, relays, levers, hydraulics, and feedback loops. The most accomplished acoustical engineer may glance to the heavens as he says “I wish I knew how to design that and make it work!” Another opportunity for amazement at the powers of evolution – or quality of somebody’s engineering staff – whatever your inclination. And, while we’re at it, the inner ear is supposed to tell us which end is up. Now tell me that’s not all weird.

Oh, if you’re curious as to how that “which end up” thing works, look at a half full wine glass. The liquid stays at the bottom, right? Now swirl the glass vigorously for a bit then set it down. You’ll see the liquid run round and round like it was about to go down a drain, then slow and stop. That’s what happened to the liquid in your inner ear when your big brother spun you a bit and laughed as you tottered around for a few seconds trying to figure out which way was up. It’s likely we all took our turn entertaining and being the entertainment while growing up.

Diane Acherman, in “A Natural History of the Senses,” a contributor to this talk, points out humankind’s early need to sort sounds; a gently swishing field of grain that seems to surround one in an earthy whisper doesn’t have the same urgency as a panther growling behind and to the right. There is a geographical quality to listening.

At times we use sound to overwhelm our thoughts as dropping off to sleep with the soothing sound of the surf, real or recorded. Or peak our spirits like the Moody Blues or the Village People who rattle the windows of our house. Y-M-C-A. Or we suppress sound with muffs, earplugs, or even fingers in our ears. Either that’s too noisy or I don’t want to hear that!

On the other hand, we sometimes want a sound to leap out at us; a baby’s cry from the other end of the house wakes us where the louder and more abrasive sound of the early morning garbage truck will not. At a busy cocktail party in a room with a low ceiling and poor acoustics, sound waves hit the wall and bounce back rather than being absorbed, and you feel as if you’re in the center of a hand ball court in the middle of a game. yet you can slice straight through all the noise to hear one conversation taking place between your spouse and a flirtatious stranger. It’s as if we had a zoom lens on those ears. Our ability to move some to the almost unnoticeable rear and drag others right up front is truly astonishing. Have you thought about how we do that?

(Charley at the piano)

As amazing as our hearing is, it does function within limits. At the peak of our youth, we hear between 16 cycles per second on the low end and 20,000 cycles per second on the high – almost ten octaves – and that encompasses a vast array of sounds. **The piano covers only seven octaves.** The male human voice is about 100 cycles per second. {**Shirley – the female human voice is about 150 cycles per second.**} Middle

C is only 256 cycles per second. (**Middle C**) As we age the eardrum thickens and we typically lose range at both the lower and upper limits, especially the high notes. Elephants, whales, and alligators communicate below our hearing limits. Bats and bugs, to name a few, above our limits. Even though our hearing has its limits, we are skilled extenders of our senses. Our forefathers pressed an ear to the ground to listen for approaching predators or herds of prey. The world-wide twitching and convulsing to the sound of fingernails on chalkboard exists even among those who have never seen a chalkboard. This must mean it is biological, not learned. Is it the sound of a predator's claws on rock as the last sound that the ancient human heard? If we were Kalahari Bushmen, we would be sleeping in the open tonight, one with their right ear to the ground, our partner with left ear cupping the earth – a fire between us – asleep but alert to the vibrations transmitted by the earth. Old ways had new applications – listening to ground vibrations to track buffalo herds across the plains yielded to listening to a railroad rail in anticipation of the Northern Pacific behind the mountain or over the horizon.

A doctor listens better to a patient's heart with a stethoscope and we hear from the deep reaches of space and time by means of a radio telescope. We use echolocation sound over 20,000 cycles per second to locate tumors in our bodies and "see" unborn babies. We put flea collars on our cats and dogs that scream unpleasantly at ticks and fleas and we plug remarkably small electronic speakers in our ears when our hearing fades. Ultrasonics can now lift things and hold them in place without touching them allowing new metal alloys to be manufactured at temperatures that would melt containers. If we could hear the sound of this levitation device, it would be like standing next to a jet engine. But like flea collars and unborn baby scans, its outside our hearing range.

What we do hear occupies quite a large range of intensities, but we rarely hear the internal workings of our own body. At most, if we are wearing earplugs or press our ear to the pillow, we hear our heartbeat. For a baby in the womb, the mother's heartbeat is the ultimate cradlesong of peace and plenty. Do we ever forget that sound? When babies begin to talk, their first words are usually in that same rhythm: Ma-ma, Pa-pa, boo-boo. Parents can even buy a small box to go in the cradle that thum thumps at a regular heartbeat rate of about seventy beats per minute. But if experimentally the boxed heart is set faster than normal, so that it suggests an unhealthy mother, or a mother under stress, the baby will become agitated. Lovers, cuddling in bed in the morning, pressed tight as spoons, feel each others heartbeat and warmth enveloping one another and are at peace. Music scores for films reflect love and peace with that rhythm and speed the ba-boom, ba-boom to lead us to more stressful emotions.

Hearing effects thought, perceptions, mood, and can drive the mind to ecstasy. Recall for a minute the primitive ceremonial drum beats and frenzied dancing depicted in bad movies and good documentaries – Native Americans, darkest Africa, the voodoo of the Caribbean and parts of our South. Staying with that recollection of those scenes, turn off the sound – that steals the impact and significantly diminishes the religious overtones. Is there such a thing as theological hearing?

Poems have traditionally been written in iambic pentameter, which sounds like ba-boom, ba-boom, ba-boom, ba-boom, ba-boom. [Read an iambic pentameter poem] Of

course, there are many other meters and no formal meter, but there is something innately satisfying about reading a poem in iambs. For one thing, it is the rhythm of a casual stroll, the pulse of our silent metronome.

Because we can hear, -- because we can hear, -- we open our mouths, force air from our lungs through our larynx, our voice box, and through an opening in our vocal cords which vibrate into speech. It seems so simple, but it's made it possible for empires to rise and fall; for children to reach small workable armistices with their parents; for corporations with their workers to build nations; for governments to destroy economies; for lovers to inspire the highest mountaintops and deepest chasms in relationships; and for societies to express their loftiest dreams and most vile prejudices. Can you imagine all this developing if we could not hear?

Consider the amazing flexibility of our hearing and interpretation system. I've told some of you the story of our little three or four-year-old neighbor girl in Germany who, with our welcomed encouragement, wandered in and out of our apartment at will. She would chatter along in German until she perceived she had used a word we didn't know then immediately switch to English until her thoughts exceeded her vocabulary. Her automatic response was to switch to Portuguese that would last only until she recognized a totally blank look on my face. No problem for her. It was back to German to start the whole sequence over again. She was much less than a yard tall, but I felt tiny next to her. Her young mind absorbed the English of her Father, the German of her Mother, and the Portuguese of her Father's last six month GM auditing assignment. The awesome three-year-old mind by far out performed the 28-year-old in learning languages. We even reach the limits of comprehension among the dialects in our own language. One person leaves the car in the parking lot while another leaves the *CAH IN THE CAH PAHK*. Ackerman tells of a visit to Arkansas having heard of a local hot springs. She asked about the presence of spas in the area. Her host promptly informed her that he doubted if any Russian agents had an interest in their community. We rarely hear our own accent. The French Academy that keeps track of such things states there are nearly 2800 separate languages on the planet, 2796 to be exact as the Academie Francaise always tries to be. In the mind of some, all but one of these languages is of any value. A French Master of Ceremonies on the Ivory Coast of Africa once said to me, in French, "If you don't speak French, you don't speak at all." Is it any wonder that understanding among peoples is such a problem?

Basque, an extremely difficult language of northern Spain and Southern France, is unique with no apparent relation to any other language except one of the 80 languages of the Caucus Mountains, north of Iran. Basque is thought to be a remnant of a cave language spoken before the glaciers last covered much of the Northern Hemisphere. The Basque word for knife is a compound that means, literally, "the stone that cuts" and, for ceiling, "roof of the cave." The tenacity of the Tangier Islanders pales in comparison with the tenacity of the Basque region when it comes to protecting and preserving their particular way of hearing a variety of sounds, coded by voices, to represent thought and ideas.

This co-dependency of hearing and speech has had such miraculous (and I use that word cautiously) miraculous impact on mankind. We have found no other creatures that approach the complexity of our communication system and more than one researcher attributes the development of that ability as the make / break issue as to why we are not still living in trees and caves. It's not hard for me to understand those who assign words such as "miraculous", "God-given", or "cosmically inspired" to these abilities. I've stumbled upon a new phrase for this fascination – phenomenological devotion. I doubt that that will catch on. The "Wonder of Us" is so much simpler.

How can I speak of our awesome system of hearing without mentioning music? Mesopotamian musical instruments go back some 5,500 years. oriental music supposedly goes back to 2700 B.C. when Huang Ti, the emperor, ordered bamboo pipes cut to the right length so he could imitate the sounds of the birds. The Mayans played an intricately carved array of clay whistles, flutes, and recorders. The point is that where ever humankind developed, he gravitated toward music. How far back the human voice was used for music cannot be known – no more than who taught the whales to sing.

One of the most soothing things is to put your tongue behind your teeth and sing la-la-la-la-la. When we sing, not only do our vocal cords vibrate, but so do some of our bones. Chant "Om" in a solid prolonged tone and you will feel the bones in your head, as well as the cartilage in your sternum, vibrate. It's like a message from inside...very soothing. The Hebrew davening, the drumbeat of a macumba ceremony, all these sounds repeat hypnotically. Every religion has its own liturgy. – Well, almost every religion -- It's repeated over and over until it becomes an aural landscape. Consider the Romanesque churches with high, vaulted ceilings, parallel walls, and a long arcade – an ideal space for processions and the reverberations of the Gregorian chant. Later, in the Middle Ages, people made the extraordinary discovery that many tones could be made at once without canceling one another out or resulting in mere noise, and polyphony was born. it seems impossible it took so long but music is not like vision. Blue and yellow mixed gives a new color, but certain tones combine into chords without losing their individuality. Thus in a Gothic Cathedral like Notre Dame, with all its nooks and crannies, a Gregorian chant would be broken up and fragmented, whereas many voices can rise, mingle, and fill the elaborate space with glorious song. [This modern sounding observation was made by Abbe Suger, counselor to Eleanor of Aquitaine, in the 12th century.] Hearing and sound designed churches – and still does.

Music tweaks our senses creating a wide variety of emotions. And these are not learned responses – there is something deep down inside of us that responds emotionally to what we hear. Manfred Klein, the Australian physiological psychologist, played passages to Bach to Japanese, Americans, Australian Aborigines, and others while electronically monitoring their responses. The emotional states in all listeners corresponded to those in the passages of Bach. Music has been used to reach comatose patients and autistic children. Musical chords were even used to reach far-flung creatures in "Close Encounters of the Third Kind" – Oh! I guess that was fiction, wasn't it.

Daryck Cook, in "Language of Music", offers a musical vocabulary with a minor seventh...////.....as "mournfulness", a major seventh ...////.....as "violent longing", and a minor second.....////.....as "spiritless anguish." While Cooke might be splitting hairs here, the point is made. Our hearing of tones spell out emotional effects that can

establish moods and reactions that range from abject depression to the ecstasy of mystical moments brought on by the deepest meditation and the most intense spirituality of the devote.

Think back with me – think back in time. Imagine the earliest of religions. Put yourself there. Imagine. What do you hear? Certainly not silence. Whether you imagined the beating of sticks on a log to build courage, the wailing of a voice mourning loss, the group chanting to ward off evil, or the words of puzzlement over the unexplainable of the age, these sounds were made to be heard – and move others. And it does.

Why is this so? Its only variations of the noise working its way through that contraption that that ingenious plumber put together from spare parts. Yet it means so much. Awesome stuff, huh?