The newsletter of
The Acoustical Society of America

ECHOES

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Outreach to High School Students and Teachers

Uwe J. Hansen

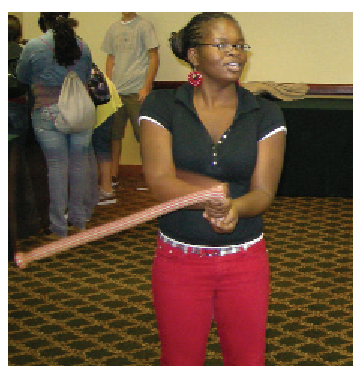
High school students experiment with acoustic levittion.

During the past decade the Committee on Education in Acoustics and the Technical Committee on Musical Acoustics have teamed up to conduct a variety of successful outreach activities. These have included about 15 hands-on sessions for high school, middle school and elementary school students and six workshops for teachers with emphasis on laboratory experiments

High school students hands-on experiment sessions have become a regular feature of ASA meetings. Hundreds of high school physics students and their teachers have been guests at ASA meetings for a brief lecture on acoustics, a session of hands-on experiments, and a pizza luncheon. Miami was no exception. Forty students and their physics teacher spent Thursday morning doing hands-on experiments with ASA volunteers acting as mentors (much thanks to those who volunteered!). Included among about 20 experiments were simple wave propagation on a long spring, standing waves on a string, Chladni patterns on a plate, comparing transverse and longitudinal waves, spectral analysis and synthesis, as well as sophisticated experiments on acoustic levitation, and thermoacoustics. Musical instruments continue to be attention getters (see, for example, the photo of Iowa State University percussion teacher Barry Larkin on p. 5 of the Winter 2008 issue of *ECHOES*).

The Acoustical Society now owns a kit of materials for these workshops that is shipped to and from the ASA meeting hotel, but ASA presenters and volunteers also loan us equipment, and often come along to instruct students in its use. Three laptop computers, donated by Merrimac Capital Co, LLC of Denver, serve as spectrum analyzers. Other materials were donated by Arbor Scientific, and Pasco Scientific. Additional equipment, such as the ultrasonic generator for the levitation experiment, and the Bose head-set for the active noise control demonstration, were purchased with ASA funds.

The Committee on Education in Acoustics and the Technical Committee on Musical Acoustics have held several high school teacher workshops, some in connection with ASA meetings. At the Houston meeting in 1991, for example, we held a workshop including teachers at the college level, which began on the last day of the meeting and extended



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We hear that . . .

• The **U.S. Physics team** won four gold medals and one silver medal at the 2008 International Physics Olympiad in Hanoi this summer. Heartiest congratulations to the five-member team and their coaches! Prior to the competition, the team sharpened their skills at a training camp held in College Park, MD.

• The Institute of Acoustics (IOA) awarded its 2008 Engineering Medal to Professor **Robert White**, Institute of Sound and Vibration for his "remarkable and sustained contribution to the field of acoustical engineering." The award was presented at an IOA conference in Oxford.

• **Judith Bell** of Heriot Watt University in Edinburgh received the 2008 A. B. Wood medal from the Institute of Acoustics (IOA) for her work on underwater noise measurement. The medal was presented at an Underwater Noise Conference in Southampton, October 14-15.

• In order to encourage more papers, there is no longer a $100 publication charge for Proceedings of Meetings in Acoustics (**POMA**).

• ASA will cosponsor **a Congressional Science and Engineering Fellowship** for 2009-2010. The program, a joint venture with the American Institute of Physics, is described in an announcement at http://aip.org/gov/fellowships/cf.html. Deadline for applications is January 15th.

The Congressional Fellows program provides an opportunity for accomplished scientists and engineers with public policy interests to learn about and contribute to the policy-making processes in Congress. Congressional Fellows spend one year serving on the staffs of Members of Congress or congressional committees, working as special assistants in legislative and policy areas that would benefit from scientific and engineering input. The program includes an orientation on congressional and executive branch operations and a year-long seminar series on issues involving science, technology and public policy, as well as monthly career enhancement workshops.

ECHOES

Newsletter of the Acoustical Society of America

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The Acoustical Society of America was organized in 1929 to increase and diffuse the knowledge of acoustics and to promote its practical applications.

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Best student paper awards (Miami)

Engineering Acoustics
First: George Lewis, Cornell University
Second: Scott Porter, Penn State University

Musical Acoustics
First: Summer K. Rankin, Florida Atlantic University
Second: Hiroko Terasawa, Stanford University

Speech Communication
First: Elizabeth Hunt, MIT
Second: Joseph Toscano, University of Iowa

Outreach to High School Students and Teachers

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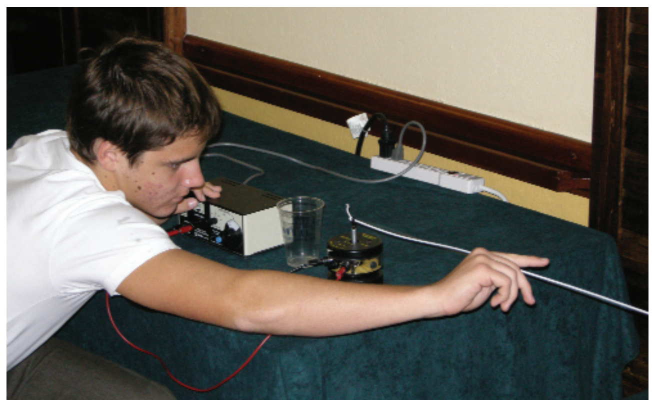

over the weekend. This workshop emphasized basic acoustic principles, demonstration equipment, and laboratory exercises. Similar workshops were held in Baltimore, Salt Lake City, Indianapolis, Nashville and Terre Haute. The workshop in Indianapolis extended over two days as a double session with one session emphasizing secondary schools and the other primarily designed to help elementary teachers. A feature of these workshops has been "make and take." Teachers assemble equipment for demonstration and laboratory experiments using pre-cut parts. Science supply houses have donated supplies and equipment to make these workshops valuable and successful.

Who knows how many future acousticians we have created with these outreach activities?

Uwe Hansen is professor emeritus at Indiana State University, where he also served as department chair 1994-97. He is an ASA Fellow and has chaired several ASA committees including the Technical Committee on Musical Acoustics and the Committee on Education in Acoustics. He is best known for his outreach activities in acoustics, especially to high school and middle school students and teachers.

Uwe Hansen

Aural Architecture: The Missing Link

Barry Blesser

While concepts such as architecture, acoustics, sound, perception, and anthropology have been part of our culture for centuries, they are usually considered in isolation from a narrow perspective. In contrast, *aural architecture* combines and reconciles them into a single interdisciplinary perspective, providing a new way of looking at the human experience of sound and space.

Acoustic scientists and aural architects are fundamentally different. The former have the skill and experience to design a space that will have specific measurable acoustic properties (physical acoustics). The latter are able to discover what aural properties would be functional and desirable for the inhabitants (cultural acoustics). By focusing on aural architecture, we can design (real or virtual) spaces that better match the needs of the inhabitants.

Many of us have dined in an upscale restaurant where conversation is almost impossible because of high ambient noise levels. In such restaurants the acoustics of the space are inappropriate for social contact, and diners are forced to shout at each other as if they were functionally deaf. Instead of enjoying an intimate evening, the diners might as well be at a basketball game. Whether consciously designed or not, the restaurant has an aural architecture just as it has a visual architecture. This simple example illustrates that the acoustic properties of a space strongly influence the emotions and behavior of the inhabitants.

We forget that hearing is more than understanding speech and enjoying music. We become aware of an unhappy baby by the sound of crying, an automobile moving at excessive speed by the sound of screeching tires, an approaching storm by the sound of distant thunder, the presence of a predator by the sound of soft footsteps, a dangerous fire by the sound of crackling combustion. In our personal interactions, we sense the internal emotional state of a lover by speech intonation, regardless of linguistic content. Sound connects us to the dynamic events of life, thereby bringing remote events into consciousness.

Sound sources and spatial acoustics interact with each other in a dual way. On the one hand, although mechanical vibrations and impacts produce a sound at their source location, we never hear those original sounds. Rather, as sound waves propagate from the source location to the listener, they are modified by spatial acoustics. For example, the sound of a clarinet is different when heard at a beach versus in a concert hall, and a whisper sounds different in a forest than in a bowling alley. On the other hand, spatial acoustics is itself audible. For example, we hear the emptiness of an uninhabited house, the depth of a cave, the nearness of a low-hanging ceiling, the expensive carpets in the executive suites, and the density of an urban city with cavernous avenues. Sound sources "illuminate" the audible properties of a space.

To illustrate that we can hear passive objects, slowly walk towards a wall in a room containing ambient noise while your eyes are closed, and stop 6 inches before hitting the wall. Most people can do it the first time and everyone can do it after a little practice. We "hear" a wall even though it is not itself a source of sound because the wall changes the spectral balance of ambient noise. Similarly, it is easy to hear the difference in the spatial volume between a living room and a cathedral. *Auditory spatial awareness*, hearing passive objects and spatial geometries, is an ability shared among dozens of mammalian species, including human beings.

Aural architecture refers to the human experience of sound-in-space; the aural architecture of a space modifies the experience of sound sources as well as providing a means for experiencing passive objects and geometries directly. In order to discuss the dual experience of aural architecture without reverting to the narrow scientific concept of physical acoustics, we use the word *spatiality* for describing how people experience space by listening. Aural architecture contains at least five types of spatiality: navigational, social, musical, aesthetic, and symbolic.

Navigational spatiality is the ability to use auditory spatial awareness to "visualize" a space in order to navigate around objects and geometries. In 1749, the French philosopher Diderot reported the ability of some blind individuals to "see" by listening. In laboratory studies, some individuals could distinguish square, circular and triangular objects only through hearing. The jazz musician Ray Charles and the Indian writer Ved Mehta moved through space without either vision or conventional aids for the blind.

Social spatiality refers to the way spatial acoustics influences the behavior of the inhabitants. An *acoustic arena* is that region of space within which individuals can hear a specific sound. Outside of the acoustic arena, an individual is functionally deaf to that sound. The ability (or inability) to hear a sound creates invisible boundaries that acoustically delineate spatial regions. Consider the following: we have all attended parties where the space is so noisy that our social acoustic arena does not even include the person standing next to us. Alternatively, a guest laughing loudly may have an arena that includes the entire house.

People are most comfortable when the acoustic arena matches the appropriate social distance. For intimate lovers, the arena should be no larger than 1 foot; for a public lecture, the arena can be 100 feet. In Hogarth's painting, *The Enraged Musician*, his pri-

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Echoes from Miami

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vate parlor and the street are both part of a single arena, even though the two spaces appear to be visual distinct.

Symbolic spatiality refers to those aural attributes that have acquired additional meaning by being associated with specific activities occurring within particular spaces. Over time, the acoustic properties of spaces become linked to the symbolic meaning of those places.

Consider the enveloping reverberation of a grand cathedral; it acquires religious symbolism. Similarly, the unique acoustics of forests and mountains can become a symbol of nature; the hushed quiet of an elegant office can become a symbol of wealth; and the diffuse echoes of a vast office entry can become a symbol of power.

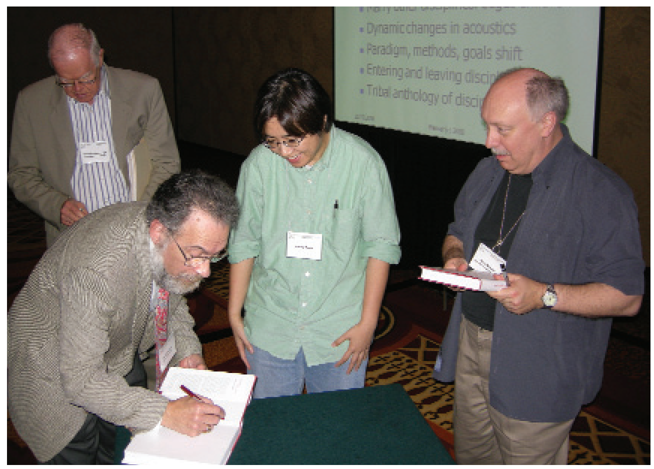
Aesthetic spatiality refers to the experience of localized acoustics that provides varying auditory texture and variety. Just as a window seat can provide visual aesthetics, an alcove also provides acoustic variety. Consider, for example, a wall composed of alternating resonant cavities, absorption panels, and reflective surfaces that change the experience of sound as one moves along its length. Local regions within a single space can have different acoustics. For example, the domed ceiling in one region of a corridor at the Houston airport provides a surprising experience while walking through the space. Momentarily, the echoes of footsteps appear and then suddenly disappear. The sudden change in local acoustics creates a sense of a textured space, like a change in color or lighting.

Music spatiality refers to the influence of the acoustics of a space on the music performed within that space, which is composed of two primary attributes: *temporal spreading and spatial spreading.*

Spatial reverberation changes the time structure of music by extending the duration of all musical notes. Consider a sequence of three notes from a clarinet played in a reverberant space. The pitch of the first note continues as reverberation while the second is being played; and when the third note is played, the pitches from the first and second are still present as reverberation. This creates a chord-like blending of the three notes.

Spatial reverberation also transforms a musical note located on stage into enveloping reverberation that embeds the listener in ocean of sound that has no apparent location. From a biological and evolutionary perspective, our binaural ability to localize prey and predator had important survival value. Conversely, the inability to localize would have produced increased anxiety, awareness, and arousal. A sound that cannot be localized is evaluated differently from one that has a location. When we experience enveloping reverberation, it is like *aural caffeine*, a stimulant. Listeners who were privileged to hear Stockhausen's performance in the Caves of Jeita in Lebanon described the mystical experience of being in an ocean of ethereal sound.

Aural architecture, with its five manifestations of spatiality, explains how the combination of sound and space influences human emotions, behavior and experience. When we design or select a space, we are therefore functioning as aural architects.



Barry Blesser, an engineer and management consultant, developed the first commercial digital reverberation system. He is a Fellow of the Audio Engineering Society (AES), and served as president in 1980. He has been awarded the Silver, Bronze, and Governors Medal by AES.

This paper is a slightly edited version of the lay language version of the Vern O. Knudsen Distinguished Lecture (paper 3pAA1) presented at the 156th ASA meeting in Miami. The lecture was followed by a book signing of Spaces Speak, Are You Listening? Experiencing Aural Architecture by Barry Blesser and Linda-Ruth Salter, MIT Press, 2006

New Fellows

(l to r): Mark Hamilton (ASA President), Ann Syrdal, Armen Sarvazyan, Joe Posey, Marshall Long, Yiu Lam, Keith Kluender, Bruce Gerratt, John Fawcett, George Bissinger, David Berry, Victor Sparrow (ASA Vice President)

Scanning the Journals

Thomas D. Rossing

• An **array of holes in a solid plate** can reduce the sound transmission at certain wavelengths according to a paper in *Physical Review Letters* **101**, 084302 (August 2008). Dubbed "extraordinary acoustic screening" (EAS), the effect could be used to design acoustic shields that block sound while allowing air and light to pass through. The effect was first noticed with ultrasonic waves in a tank of water. The attenuation, which is greater than predicted by the mass law, is greatest when the spacing between the holes is about the same as the wavelength of sound.

• **Sensitivity to sudden noises** may predict your politics, according to a paper in the September 18 issue of *Science*. Adults with lower sensitivities to sudden noises are more likely to support foreign aid, liberal immigration policies, pacifism and gun control. On the other hand, persons with measurably higher physiological reactions to these same stimuli are more likely to favor defense spending, capital punishment, patriotism, and the Iraq war.

• **Sound can travel further** than it did a century ago, thanks to carbon emissions making oceans more acidic, according to a note in the 27 September issue of *New Scientist*. The reach of low-frequency sounds varies between oceans. A whale's call, for example, travels further in the north Pacific than in the north Atlantic, due to differences in pH. Exactly how the difference arises is unclear. Some research suggests that ion pairs of carbonate, bicarbonate, boric acid and borate are tuned to absorb energy from sound waves of 1 kHz and below. The acidity of the water affects the balance between these chemicals. Some studies predict that ocean pH could drop by an average of 0.3 before the end of the century. This could cause a 40 per cent decrease in the sound absorption below 1 kHz.

• Gene transfer to the **inner-ear precursor cells** of developing mouse embryos can be used to induce formation of functional hair cells, according to a letter in the 25 September issue of *Nature*. The technique of transfection has been used to introduce the gene encoding Atoh 1 directly into inner-ear progenitor cells of mouse embryos wile still in the uterus. The transfected cells displayed their characteristic bundles of hairs. They also seemed to form the correct neural contacts with afferent nerve fibers, thus allowing the newly formed cells to interact with the auditory nervous system. .

• **Advances in speech processing** may soon place speech and writing on a more equal footing, according to an article in the 26 September issue of *Nature*. The best available evidence suggests that the human brain and the human facility for language were already well developed at least by 50,000 years ago. About 5000 years ago, we see the first indications of the emergence of written language. Writing has some advantages over speech, including a degree of permanence that can help to overcome some limitations of human memory. For the past century and a half, inventors have chipped away at these advantages. The invention of the phonograph and later wire recording and tape recording gave permanence to speech. Today, digitized speech is easily acquired and easily stored. How can we harness this new technology to accelerate access to new knowledge? Our parents complained that our generation relied on calculators rather than learning arithmetic. Will we complain when our grandchildren rely on speech-enabled system rather than learning to read and write?

• The **speed of sound in a bubbly liquid** is strongly dependent upon the volume fraction of the gas phase, the bubble size distribution, and the frequency of the acoustic excitation. At sufficiently low frequencies, the speed of sound depends primarily on the gas volume. An apparatus and demonstration note in the October issue of *American Journal of Physics* describes a way to audibly demonstrate this in a one-dimensional acoustic waveguide. The normal modes of the waveguide are excited by the sound of bubbles being injected into the tube. As the flow rate is varied, the speed of sound varies as well, and hence the resonance frequencies shift. This can be clearly heard through the use of an amplified hydrophone and used to verify Wood's equation that relates the speed of sound in a bubbly liquid to its void fraction.

• When two hard balls collide, a negligible fraction of the initial energy is converted to vibrational energy because the collision time is much longer than the transit time of an **acoustic wave across each ball**, according to a paper in the October issue of *American Journal of Physics*. This is due to the fact that the contact region of a hard spherical ball is much softer than the rest of the ball. The paper also analyzes bouncing balls, bouncing springs, and bouncing rods. It concludes that the bounce properties of various balls, springs, and rods are qualitatively consistent with a simple mass-spring chain model in all cases. The impact time of a spring (or a long rod) bouncing off a heavy, rigid surface or off another spring (or rod) depends on the propagation time of a compression wave from the impact point to the other end and back again. The impact force on the spring or the rod remains approximately constant in time.

• Active volcanoes are not unlike orchestras in that they emit a **mix of seismic signals** that vary in periodicity, according to a paper in the 10 October issue of *Science*. Because each type of signal is associated with different physical processes, seismic monitoring can be a powerful tool for eruption forecasting. The problem is how to associate volcanic processes such as fracture, magma feeding, and degassing with each type of earthquake. One approach is to recreate volcanic conditions with small laboratory samples and then extrapolate the signals (sonic to ultrasonic) to the scale of volcanic features. This technique has been applied to a sample of basalt from Mt. Etna, and the frequency-time-intensity data represented on a plot resembling a sound spectrograph.

• **Changes in absolute hearing threshold** depend on the sound level of a previous sound, according to a paper in the September issue of *Acoustical Science and Technology*. The threshold was decreased when the previous sound was presented in the contralateral (opposite) ear, but increased in the ipsilateral (same) ear.

• The Priests at an ancient temple in Peru may have learned to

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manipulate their temple's acoustics to create the illusion that they channeled the power of the gods, according to an article in 6 September issue of *New Scientist*. A team of acousticians and archeologists has been studying the acoustics of a temple complex at Chavin de Huantar in order to understand how the priests may have used acoustics to shock and awe their subjects who visited. The archaeologists also discovered 20 identical trumpets, made from a type of conch shell called a strombus, in one of Chavin's underground chambers. Recordings of how various noises sound in the chambers seemed to show that the complex network of galleries was designed to turn the trumpet blasts into a truly otherworldly experience. The resonant frequencies of the chambers match typical frequencies of the human voice and of the strombus trumpets, amplifying both.

• One particular tree frog in China is quite adept at using **sound for localization**, according to a note in the 12 June issue of *Nature*. Females of the concave-eared torrent frog (*Odorrana tormota*), which lives around noisy rivers at the Huangshan hot springs in China, make chirps in the range 7.2–9.8 kHz, with harmonics up into the ultrasonic region to let males know they are ovulating. Males can locate them with an astonishing precision of less than 1°, a feat of localization comparable to dolphins, barn owls, elephants and humans.

• Software that turns ordinary **cellphones into musical instruments** is reported in the 8 November issue of *New Scientist*. Gesture-recognition software is predicted to "democratize music-making as never before." The software monitors a phone's motion and plays a corresponding sound. The software runs on a wide range of phones because it uses many different ways to sense gestures, including accelerometers built into several types of smart phones. But the software can also trigger sounds when the view through a phone's camera lens changes rapidly or generates a beat from simple taps on the microphone.

• **Ultrathin loudspeakers** made from whiskerlike carbon nanotubes are described in the 10 December issue of *Nano Letters*. Changes in the current cause the air surrounding the nanotubes to rapidly heat and cool which, in turn, produces pressure waves and sounds. This "thermoacoustic" effect was reported in metal foils more than 100 years ago, but sound from the carbon nanotubes is more than 200 times greater.

• Both cochlear amplification and distortion originate from the outer hair cells. A letter in the 13 November issue of *Nature* shows that the **nonlinearity underlying cochlear waveform distortions relies on the presence of stereocilin**, a protein defective in a recessive form of human deafness. Stereocilin was detected in association with horizontal top connectors, lateral links that join adjacent stereocilia within the outer hair cell's hair bundle in mice. These links were absent in sterecilin-null mutant mice which became progressively deaf. The authors conclude that the main source of cochlear waveform distortions is a deflection-dependent hair bundle stiffness resulting from constraints imposed by the horizonal top connectors, and not from the intrinsic nonlinear behavior of the mechano-electrical transducer channel.

• A British woman has become the first person known to be born with **phonagnosia**, the inability to recognize voices, even that of her own daughter, according to a paper in the August 13 issue of *Neuropsychologia*. Her hearing abilities are normal, and an MRI scan showed evidence of brain damage in regions associated with voice or auditory perception. The results suggest that the recognition of a speaker's voical identity depends on separable mechanisms from those used to recognize other information from the voice or non-vocal auditory stimuli.

• A new technique has been used to localize the clock circuitry that underlies the **timing of birdsong**, according to a letter in the 13 November issue of *Nature*. The method exploits the fact that the speed of brain processes is strongly temperature dependent. When the activity of the pre-motor area in zebra finches was slowed by cooling, the overall speed of songs was reduced, but the acoustic structure of elements within the song was intact

• A system for **trapping sound waves**, consisting of small aluminum ball bearings fused together, is reported in the 30 October issue of *Nature Physics*. The trapping mechanism for ultrasound is analogous to the trapping of electrons in disordered materials. When the degree of disorder is sufficient, electron waves can become localized in a single spot. The authors believe that their work may improve the understanding of localization which could have applications in electronics.

• When engineers design structures to withstand earthquakes, they rely on ground-shaking prediction models, according to a commentary in the 31 October issue of *Science*. **Seismic wave propagation** is complex because although rock layers respond linearly shallow soils can nonlinearly amplify seismic waves as a function of wave amplitude, particularly near the surface. Ground-motion observations at the surface do not uniquely constrain models of surface motion, so specialized recording networks have been created.

• Functional magnetic resonance imaging combined with a data-mining algorithm have allowed retrieval of what and whom a person is listening to from neural fingerprints that **speech and voice signals** elicit in the listener's auditory cortex, according to a report in the 7 November issue of *Science*. These cortical fingerprints are spatially distributed and insensitive to acoustic variations of the input so as to permit the brain-based recognition of learned speech from unknown speakers and of learned voices from previously unheard utterances. The pattern associated with a vowel does not change if the vowel is spoken by another speaker, and the pattern associated with a speaker does not depend on what the person says.

Acoustics in the News

• Worm grunting involves driving a wooden stake into the ground and rubbing the top of it with a flat piece of steel to make a grunting or snoring noise. Done in the right place under the right conditions, the result will be hundreds of earthworms that can be used for fish bait appearing on the surface of the ground. The mystery of why the vibrations cause worms to the surface has been solved, according to a story in the October 17 issue of *The New York Times*. Worm grunting mimics the sound of a predator, the eastern American mole, causing the worms to flee topside. The frequencies of worm grunting, while not a precise match, overlapped reasonably well with those created by the moles.

• Subtle shifts in density that occur within individual pieces of wood might explain why violins made in eighteenth century Cremona sound so special, according to a note in the 3 July issue of *Nature*. A medical researcher and a violin maker, using computed tomography, measured the densities of five classical violins, including two by Stradivari, and eight modern instruments. The difference in density between spring and summer growth and maple was significantly smaller in the classical instruments than in the modern ones. These variations in density may influence the wood's acoustic properties by affecting its stiffness.

• Smoke alarms could save more lives if the noise they made were a little less shrill, according to a story in the 18 October issue of *New Scientist*. Researchers played nine different alarm sounds to adults in the early part of their sleep. They found that people awakened fastest when exposed to a square-wave signal with a fundamental frequency of 520 Hz plus some other low tones. Most fire-related deaths at home, whether the houses have smoke alarms or not, happen in the first 3 hours of slumber, when people are sleeping most deeply.

• A new technique for clearing blockages in undersea oil pipes uses sound pulses generated by abruptly closing a valve at the end of the pipe. The resulting change in momentum initiates a pressure pulse within the oil, which travels back down the pipe at the speed of sound, according to an article in the October 1 *physicsworld.com*. A pressure sensor positioned just under the valve reveals both the position and the size of the blockage.

• A slight difference in the sounds created by neutrons and alpha particles as they travel through a liquid could lead to the first direct detection of dark matter, according to a story in the October 16 *physicsworld.com*. Dark matter is thought to constitute up to 95% of all matter in the universe, but has never been observed directly. Buried deep underground in a former mine to shield it from cosmic rays, PICASSO is a bubble chamber containing 80 g of C4F10 fluid that is superheated above its boiling point. It detects subatomic particles via the bubbles they create when they collide with nuclei in the fluid. Bubble creation is detected through sound that is created when a bubble forms. Most of the background noise in PICASSO comes from alpha particles that are given off by radioactive contaminants in the detector. It is essential that experimenters can distinguish weakly-acting massive particles (WIMPS) from alpha particles. A ready source of WIMPs is not available, so neutrons are used instead.

• Included in the list of the 50 best inventions of the year in the November 10 issue of *Time* is Sound-Enhanced Food. A chef found that playing a recording of breaking waves makes an oyster taste 30% saltier than the same food eaten to the noise of barnyard animals. At another restaurant, the Sound of the Sea dish comes with an unusual side: an iPod loaded with sea sounds.

• The presidential campaign of 1908, in which William Jennings Bryan campaigned against William H. Taft, was the first in which presidential candidates recorded their own voices for mass distribution, according to a story in the September 26 issue of *Science News*. Bryan made 10 records for Edison, while Taft made 12. The recordings were played at rallies, in concert halls, and at local Edison dealerships. Reaction to this novelty was mixed. Some political cartoons portrayed Bryan as a blowhard who loved nothing better than his own voice. The public was used to thinking of the phonograph as an instrument for entertainment, not serious contemplation. Both candidates took care to speak seriously and in measured tones.

• The 500-year old Vitthala Temple in the south Indian city of Hampi has numerous pillars, each of which includes separate columns that sound musical notes when struck with a finger, according to a note in the November issue of *Physics Today*. Different columns in a pillar produce sounds of different frequencies. Scientists at the Indira Gandhi Center for Atomic Research have studied recorded sound from the columns and also used *in-situ* metallography, low-frequency ultrasound and impact-echo testing to study them. They have concluded that the pillars' sounds arise from flexural modes of vibration.

• Female barking tree frogs use complex calculations to pick out the loudest male in a chorus as a potential mate according to an article in the 6 September issue of *New Scientist*. Females generally prefer louder calls, probably because they indicate a bigger, stronger male. They are somehow able to pick out the loudest male even when distance makes him sound quieter than a nearer rival. This suggests that females have some way of judging a male's distance apart from how loud his call appears. Scientists suspect that the frogs estimate distance by triangulation, a complex calculation that determines how quickly the direction of the sound changes as the female moves.

• People who go deaf as adults can chat intelligibly for years afterward. Now, according to an article in the 15 September issue of *Science*, scientists may have figured out how. Neuroscientists suspected that in addition to listening, people pay attention to muscles in their own faces, tongues, and vocal tracts to judge whether they are saying words correctly. To test the theory, they recruited adult volunteers, some with normal hearing and some who had gone deaf within the past 20 years but who wore cochlear implants. The crux of the experiment was distorting the muscular sensations of speaking by means of a robotic device that tugged their lower jaw outward a tiny amount. The tiny shifts in mouth position didn't change the way the words sound, but after repeating hundreds

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of words the deaf participants began to pull their jaws in slightly to partially correct for the manipulation. The results suggest that sensations from the jaw and vocal tract alone can be used for speech learning.

• The U. S. Supreme Court struck down restriction on the use of sonar by the U. S. Navy during training exercises that are meant to protect whales, according to a story in the 12 November issue of *Science*, saying that the rules endanger sailors' lives and national security. A coalition of environmental groups had sued the Navy to restrict its proposed use of a sonar array during exercises at sea (see Spring 2008 issue of *ECHOES*). The ruling has limited impact on whales since it deals with sonar restrictions, also known as "mitigation" measures, put on 14 exercises over 2 years. Only one of those remains to be conducted.

• Sound can be used to smooth out jerky pictures, according to a technology note in the 1 November issue of *New Scientist*. An effect used since the early days of cinema to make the action appear smoother could improve our perception of poor video footage sent to cellphones. Subjects were shown films of flashing discs of light that increased or decreased in size. When the discs flashed rapidly, they appeared to move forward or recede, while at lower flash rates they only appeared to move when accompanied with beeps that increased or decreased in volume. This parallels the way fast music helped to create an illusion of motion in early movies. It shows that sounds can fool the brain into seeing motion even with visual cues.

• Infrared light can stimulate neurons in the inner ear as precisely as sound waves, according to a news item in the 23 November issue of *New Scientist*. It is possible that such stimulation could lead to better cochlear implants for deaf people. Implants use only 20 or so electrodes, a small number compared to the 3000 hair cells in a healthy ear. More electrodes cannot be packed in because tissue conducts electricity, so signals from different electrodes would interfere. In contrast, laser light can target nerves more precisely. It is still a mystery how light stimulates the neurons, however, as they do not contain light-sensitive proteins.

• After two months of laying down acoustic devices across the Gulf of California, three vessels have completed a survey of the vaquita, a rare porpoise considered to be the world's most endangered marine mammal, according to a news story in the 27 November issue of *Nature*. In 1997 a visual survey estimated the vaquita population at nearly 600, but over the past three years a cabin cruiser converted into an acoustic lab to follow the animals sounds has estimated only 150 vaquita remain. Results from the new survey will be presented early in 2009. Each vaquita can be up to 1.5 meters long and have a mass of about 50 kilograms.

• Musicians are demanding that the U.S. military stop using their songs to torture detainees in Iraq, Afghanistan and Guantanamo Bay, according to an Associated Press story in the December 10 issue of *San Jose Mercury News*. For detainees who grew up in Afghanistan, where music was prohibited under Taliban rule, interrogations by U. S. forces marked their first exposure to the pounding rhythms played at top volume. The experience was overwhelming to many who wound up screaming and smashing their heads against walls, according to the story.

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