The newsletter of
The Acoustical Society of America

ECHOES

Volume 14, Number 1
Winter 2004

Vern O. Knudsen

By Robert S. Gales

Vern Oliver Knudsen (1893-1974), a founding member and third president of the Acoustical Society of America, had a long and distinguished career as a teacher, acoustician, physicist, academic administrator, and consultant. His career in acoustics began at the Bell Telephone Laboratories, and continued at UCLA, where he was head of the Physics Department, vice-chancellor, and chancellor.

Vern Knudsen outside Knudsen Hall, UCLA

Knudsen was born in Provo, Utah, on 27 December 1893. He entered Brigham Young University in 1911 and came under the influence of Professor Harvey Fletcher, whom he credits with steering him toward physics rather than mathematics or engineering as he originally planned. In his senior year he assisted Fletcher in his research on Brownian motion. Following his graduation in 1911, he served as a Mormon missionary and as acting head of the Northern States Mission in Chicago.

During World War I he investigated parasitic earth currents using the western segment of the St. Pierre cable, which had broken in mid-Atlantic. The 1700-mile segment terminated at the Chatham, Massachusetts cable station. The purpose of the measurements was to determine what could be done to speed up cable telegraph transmission of messages across the Atlantic during the war to "carry the wording communications between Woodrow Wilson and Lloyd George." He found that interfering earth currents with frequencies between about 5 to 15 Hz were largely attributable to fluctuations in the Earth's magnetic field.

Knudsen joined Harvey Fletcher at the Bell Telephone Laboratories (then Western Electric) in 1918, where he worked on the development of amplifiers and oscillators, increasing his knowledge of the new technology of vacuum tubes which Fletcher and his colleagues were using in their studies on hearing.

In 1919 he began his graduate studies at the University of Chicago as a student of A. A. Michelson. As a suitable subject for his doctoral dissertation, R. A. Millikan proposed a study of the contribution of electrons to the specific heat of metals, a problem previously investigated by Debye, Nernst, and Einstein, but not solved. Recognizing the probable long duration of such a study, Knudsen sought advice from Dean Henry Gordon Gale during a period when Millikan was in Europe. Dean Gale proposed a study of acoustics, which would be well advanced by the time Millikan returned. Knudsen worked rapidly to measure the sensibility of the ear to small differences of intensity and frequency, using vacuum tube techniques acquired from the Western Electric Research Laboratories. When Millikan returned, he approved the study and introduced Knudsen to George Shambaugh, one of the foremost otologists in the U. S. Subsequent association with Shambaugh resulted in studies on the sensibility of pathological ears to small differences in loudness and pitch and to diplacusis.

Knudsen received the Ph.D. in physics magna cum laude in 1922. He confounded both colleagues and teachers by turning down offers from the University of Chicago and the Bell Telephone Laboratories to accept the position of Instructor at the newly-formed University of California Southern Branch, later to become UCLA. The Southern Branch occupied a small campus near what is now central Los Angeles; all the buildings together were smaller than Knudsen Hall on the UCLA campus today. Knudsen overcame the lack of facilities by reaching out to his surroundings: he studied the architectural acoustics of local auditoriums and classrooms, most of which were acoustically bad.

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We hear that...

• **Leo L. Beranek** is one of eight of the Nation's leading scientists and engineers to receive the 2002 National Medal of Science. The presidential medal is the Nation's highest honor for researchers who have made major impacts in fields of science and engineering through career-long, ground-breaking achievements.

• **David Feit** received the Per Bruel Gold Medal for Noise Control and Acoustics at the 2003 ASME meeting in Washington, DC, 16-21 November.

• A special edition of *Acoustics Research Letters Online (ARLO)* is planned to commemorate the life and work of **Robert E. Apfel**, former ASA president and founder of ARLO. Contributions to this commemorative issue are solicited on acoustics topics in which he was involved, including acoustics education, physical acoustics, cavitation, drop dynamics, acoustic levitation, radiation detection, mixture laws, and the acoustic nonlinear parameter. Former colleagues of Robert Apfel are particularly urged to contribute. Publication is expected during summer 2004.

• **Richard H. Lyon** received the Gold Medal award from the Acoustical Foundation of India. The Foundation presents this award to an internationally renowned acoustician whose work has developed acoustics in the world community. The award was presented at a meeting of the Automotive Research Association of India on October 31, 2003.

• **Kenneth N. Stevens** and **Gunnar Fant** will receive the 2004 James L. Flanagan Speech and Audio Processing Award from IEEE.

75th Anniversary issue

We plan to make the Spring issue a special issue focussing on the ASA 75th anniversary meeting in New York. We will include news items and recollections from 25, 50, and 75 years ago. Please scratch your heads. If you have any ideas for such items, please send them along to the editor rossing@physics.niu.edu. The deadline for material is March 10, although we appreciate receiving it well before deadline.

We will have a color "centerfold" with photographs from 1929, 1954, 1979, and 2004. If you have any appropriate photographs from these years that we can publish please send them to me or let me know you have them available. Black and white photos are also welcome, of course, as we will use them throughout the issue.

Our admonition for all readers to submit material to share with colleagues is even more urgent for this special issue! Remember the March 10 deadline!

ECHOES

Newsletter of the Acoustical Society of America

Provided as a benefit of membership to ASA members

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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Auralization Software Gets New Boost

by David Grandall

Auralization software, used to predict the acoustics of rooms and concert halls, received a shot in the arm recently. This software utilizes anechoic recordings as a baseline for the predictions. Previously, there were only a handful of anechoic recordings available, and these were mostly recordings of individual instruments. There were no recordings of choral music, until now.

On October 21, the Wenger Corporation of Owatonna, Minnesota recorded the 80-voice Cantorei from St. Olaf College in the large anechoic room at the 3M Company in St. Paul. The choir, directed by St. Olaf music professor John Ferguson, sang a variety of works representing different types of choral literature. The recording, thought to be the first anechoic recording of a large choir, should be available sometime this spring.

The listening experience was quite amazing. Anechoic rooms are strange concert halls. One unusual experience for the choir was that their usual amount of consonants was way too much. It was a hilarious moment when the assistant director of the Cantorei told the choir to tone down the consonants. Laughter! (Singers are used to hearing just the opposite).

David Grandall, an engineering student at the University of Minnesota, a talented musician, and a grandson of the Editor, served as reporter for ECHOES.

Vern O. Knudsen

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For hearing studies he followed Shambaugh's advice and joined forces with Isaac Jones, a distinguished otologist in Los Angeles. Shortly the two were writing definitive papers on normal and impaired hearing. Some 26 audiometers were built in the Knudsen back yard and made available to doctors who agreed to use them for research. This Knudsen-Jones audiometer, with its bone conduction capabilities, was the first instrument that enabled otologists to make a differential diagnosis between conductive (middle ear) and perceptive (cochlear) impairments of hearing, and to test the cochlea directly.

In 1928, F. R. Watson (University of Illinois) and Wallace Waterfall (Celotex) visited Knudsen to discuss the formation of an acoustical society. It was decided that there should be further conferences with Harvey Fletcher, Director of Physical Research at the Bell Telephone Research Laboratory. The conference with Fletcher led to calling an organizational meeting at the Bell Labs in December 1928. At this meeting it was decided to establish a society based on "its relationship to physics rather than to engineering," and a society was formed with Fletcher as president and Knudsen as vice-president.

Our Society has honored Vern Knudsen in many ways. It elected Knudsen President 1933-36 and awarded him the Wallace C. Sabine medal in 1958 and the Gold Medal in 1967. He received the John A. Potts Memorial Award from the Audio Engineering Society in 1964.

When UCLA moved to its present location in Westwood in 1929, the Physics Department, under Knudsen's influence, was blessed with excellent acoustical facilities, including several concrete double-wall acoustically isolated rooms. A series of studies of reverberation time in these rooms showed an unpredicted dependence on humidity, and a collaboration with Hans Kneser of Germany led to programs on understanding molecular relaxation phenomena in gases and liquids.

As World War II (WWII) approached, the National Defense Research Committee (NDRC) established the University of California Division of War Research (UCDWR) in San Diego, providing a close relationship with the Navy, various ship operations, and the University of California Scripps Institution of Oceanography. Knudsen was selected to be the civilian head of this new organization, located on Point Loma, and his recruiting efforts attracted an effective team that included Ludwig Sepmeyer and Robert Gales from UCLA. Knudsen's "hatred of noise" blossomed into an international effort measuring the ambient noise of the oceans, particularly its dependence on "sea state," which is a numerical measure of surface roughness, depending on wind and wave–heights. "Knudsen curves" continue to be useful in predicting sonar detection range.

At the close of WWII, Knudsen returned to UCLA, where he and Leo Delsasso taught a course for Naval officers on underwater sound. This course, which incorporated knowledge of sound propagation and detection developed during the war, was later taught at the Naval Postgraduate School at Monterey.

Twelve years after Knudsen arrived, UCLA first offered work leading to advanced degrees. He was a prime mover in establishing the Graduate Division and became its first dean, serving in that capacity from 1934 to 1958. In 1956, he became Vice Chancellor of UCLA and in 1959 was chosen to be Chancellor, a position he held for only one year because he reached the mandatory retirement age in 1960.

"Retirement" provided Knudsen with an eagerly anticipated opportunity to return to his office in the Physics Department, where he collaborated with Leo Delsasso in the acoustics laboratories. Once more he could devote his full attention to acoustics—its theory and application. His campaign against noise, which he mounted in the 1920s, was renewed.

Vern Knudsen's legacy of 110 publications includes two books, *Architectural Acoustics* (1932) and, with co-author Cyril Harris, *Acoustical Designing in Architecture* (1950). A complete list of his publications appears in Ref. 4. In his role as an acoustical consultant, he has participated in the design of over 500 structures, some of which are listed in Ref. 1. His love of music led him to be a central figure in the Hollywood Bowl, as acoustical designer and president. He also served as president of the Los Angeles Symphony Association. At UCLA he was instrumental in securing a professorship for Arnold Schoenberg and participated in the design of Schoenberg Hall at UCLA.

Isadore Rudnick, Knudsen's very close colleague at UCLA, expressed the following tribute at Knudsen's funeral: "He will always be remembered with affection and respect by those who knew him. If a man's measure is the good he has done during his lifetime and the lasting mark he leaves on the lives of those whose paths he crossed, then Vern Knudsen was a giant among men."

References:

[1] Citation for the Wallace Clement Sabine Medal, *J. Acoust. Soc. Am.* **30**, 155 (1958).
[2] Leo P. Delsasso, Citation for the Gold Medal, *J. Acoust. Soc. Am.* **42**, 535, (1967).
[3] Isadore Rudnick, "Vern Oliver Knudsen—1893-1974," *J. Acoust. Soc. Am.* **56**, 712 (1974).
[4] I. Rudnick and T. Bomba, *Vern Knudsen Collected Papers* (Acoust. Soc. Am., 1975).

Robert Gales was a colleague of Vern Knudsen and of his son Norman for many years, both at UCLA and at the Navy Laboratory in San Diego. As ASA president in 1975 he presided at the Vern Knudsen Tribute session in San Francisco and at the banquet at which Knudsen was honored.

Echoes from Austin

Sound before light?

The featured speaker at the Fellows Luncheon was Steven Weinberg, Nobel laureate and Josey Regental Professor of Science at the University of Texas. Well known throughout the scientific community for his books and papers on elementary particle physics, cosmology, and other subjects, he is perhaps best known to the general public for his book *The First Three Minutes* (1977). His research has been honored with numerous prizes and awards, including the Nobel Prize in Physics (1979) and the National Medal of Science (1991) as well as election to both the US National Academy of Sciences and Britain's Royal Society.

Professor Weinberg reminded the audience that during the first 380,000 years or so after the Big Bang, sound waves propagated through the highly ionized plasma of charged particles, whereas light waves could not. When the universe expanded and cooled enough so that protons and electrons could combine to form hydrogen atoms, it became transparent to light and no longer propagated sound as its density decreased. Cosmic inflationary theory predicts that acoustic oscillations, caused by a tug-of-war between gravity and radiation pressure, would be generated at a variety of frequencies, with a peak at 3 x 10^{-17} Hz, 58 octaves below the bottom of the piano keyboard

Fluctuations left over from "sound waves," first detected by the COBE satellite detector, show clearly on the maps created by the Wilkinson Microwave Anisotropy Probe. [Readers of "Scanning the Journals" in *ECHOES* may recall two items in the Summer 2001 issue entitled "acoustic oscillations" and "universe rang like a bell."] "Sound tells us a lot about the Universe," Professor Weinberg reminded his audience. "Since the time our ancestors came out of the trees, sound has been the way we transmit information."

Shock waves in medicine

by Michael Bailey and James McAteer

The 146th meeting in Austin included a day-long topical meeting entitled "Shock Waves in Medicine." This well-attended symposium brought together clinicians, researchers, and representatives from industry to foster collaboration and consensus on the physical mechanisms of shock wave action in shock wave lithotripsy (SWL for the treatment of kidney stones) and extracorporeal shock wave therapy (ESWT for treatment of various musculoskeletal indications). The meeting provided a forum for review of the current status of the field and for presentation of new data. The four sessions were *Shock wave physics, Shock wave lithotripsy, Orthopedic application, and Bioeffects and devices*.

The shock wave physics session made good progress in defining the current modeling tools for nonlinear wave propagation, single bubble cavitation, and multi-bubble dynamics, and the important physical parameters in shock wave (SW) action. Shock waves and ensuing cavitation lend well to analysis by a number of models, and research has begun to focus on correlating these computational predictions to experimental observations of bioeffects, particularly kidney stone breakage and tissue injury by lithotripsy.

Lithotripters produce acoustic pulses with amplitudes in the range of 30-100 MPa, and the adverse effects of SWL can be significant. Lithotripter SW's induce vascular trauma that leads to additional damage to renal tubules and an inflammatory process ("lithotripsy nephritis") that can progress to scar formation with permanent loss of functional kidney tissue. In light of this, investigators question how the lithotripsy industry has been so successful in gaining U.S. Food and Drug Administration (FDA) approval for new devices and new concepts in SW delivery - even when the fundamental mechanisms of SW action are not fully understood. It was thus fascinating to hear the physician's perspective on the value of SWL (lithotripsy is the primary method of treating uncomplicated stones) but how this enthusiasm is tempered by concern that the industry trend toward production of more powerful lithotripters has resulted in an increase in adverse effects. It was also enlightening to hear from those who have done instrument testing for the FDA that animal studies are not required for approval, and that the regulatory standard for approval is spatial and temporal mapping of the acoustic field. The emphasis on acoustic measurement in the FDA approval process leaves a great opportunity for the ASA to influence the criteria that are used for assessment and approval of devices.

The session on lithotripsy fostered a thorough discussion on the mechanisms of SW action in stone breakage and tissue damage, and participants shared a number of new ideas that may help clarify the understanding of how SW's work. Stone breakage appears to involve both direct SW effects and cavitation. Internal tension fragments the stone, and cavitation bubble clouds further erode the fragments. A new model was presented demonstrating that the internal shear wave, not the longitudinal wave, spallation, or hoop stress, produced the greatest tensile stress at least for the stone shapes and compositions modeled. How SW's cause tissue damage may, likewise, involve multiple mechanisms, but cavitation has been strongly implicated. It is likely cavitation plays the greatest role once a vessel is ruptured and a pool of blood forms. Research focuses on exactly how the rupture occurs. Data (computational and experimental) were presented suggesting that bubble expansion within blood vessels could cause vessel rupture, and data have previously been shown suggesting spatial pressure gradients created by the focused shock wave can shear or tear the vessel.

The most recent data on the renal response to SW's clearly show that the kidney is not a passive target. Shock wave treatment causes renal blood vessels to constrict, and even a mild dose of low-energy pulses is an effective stimulus for vasoconstriction. This proves to offer an advantage toward minimizing SW injury, as vasoconstriction protects against subsequent injury. The acoustic mechanisms involved have yet to be determined, but could involve a reduction in the number of active cavitation nuclei or increased resistance to bubble expansion. But applying 100-500 SW's at low setting, before the standard clinical dose, has the potential of mitigating tissue injury, and is one example of how fundamental research has clinical impact.

The lithotripsy session also included several reports on new concepts in shock wave delivery. As more has been learned about the acoustic mechanisms at play in stone breakage and tissue damage, and with awareness of clinical data that show adverse effects with high pressure lithotripters to be on the rise, investigators are working on ways to manipulate the acoustic field and cavitation field. Use of dual pulses to enhance or mitigate cavitation has promise as a viable strategy. Also, findings with a new lithotripter that has a very broad focal zone (to enhance hoop stress) and is used at low energy, are encouraging.

Extracorporeal shock waves are also used to treat a wide variety of musculoskeletal and soft tissue indications. ESWT is used, primarily outside the United States, to treat common painful conditions such as tennis elbow and plantar fasciitis, and has been found to be an effective non-surgical method to stimulate the repair of difficult-to-heal fractures (i.e. non-union fractures). The number of ESWT procedures performed worldwide outdistances the use of SW's to treat kidney stones. Clinical outcomes in ESWT are for most applications more difficult to assess as the desired result is usually a subjective criterion such the reduction of pain or an increase in joint mobility. Very little research has been done to determine the mechanisms of SW action in ESWT. The ESWT shock wave is virtually identical to that of a lithotripter operated at low acoustic output, and ESWT devices generate cavitation. It seems reasonable that the fund of knowledge from lithotripsy may find application to future work in ESWT. Manufacturers are active in R&D of new devices including electrohydraulic and piezoelectric sources. The industry appears to be interested in promoting research in ESWT and has taken steps to establish criteria for assessment of devices.

Finally, shock waves and ultrasound can be used to make living cells permeable, opening up the possibility of therapeutic applications such as drug delivery and gene transfection. Cavitation is likely the key mechanism in this process. Introduction of air into tissue increases transfection. At the same time, cavitation is complex. The air-filled lung is the tissue most easily injured non-thermally by ultrasound or shock waves, but strong evidence has been presented that the mechanism is not classical bubble oscillation of the alveoli or bubbles in the blood in the lung tissue. Research will be required on the mechanisms of injury in order to define safety parameters for new shock wave devices.

In summary, research involving shock waves in medicine is viable and growing. Acousticians are at the forefront of this effort, and we stand in a position to help the biomedical community make best use of the fundamental mechanisms of shock wave action.

Michael Bailey is a research engineer at the Center for Industrial and Medical Ultrasound in the Applied Physics Laboratory at the University of Washington. James McAteer is a Professor in the Department of Anatomy and Cell Biology at the Indiana University School of Medicine in Indianapolis.

Frank Speller demonstrates the organ in the Bates Recital Hall, site of one of the technial tours.

New Fellows of ASA receive their certificates from President Ilene Busch-Vishniac (second from left) and Vice President Anthony Atchley (far right)

Scanning the Journals

by Thomas D. Rossing

• The September issue of *Acoustical Science and Technology* is a special issue devoted to **Spatial hearing**. Invited reviews deal with the cocktail party problem and perceptual evaluation of filters controlling source direction, and an invited paper deals with the precedence effect for noise bursts of different bandwidths.

• An **inverse Doppler effect**, in which the frequency of a wave is increased on reflection from a receding boundary, is reported in the 28 November issue of *Science*. This counterintuitive effect was produced by reflecting a wave from a moving discontinuity in an electrical transmission line. The technique produces frequency shifts of over 20% from a single Doppler reflection by creating a boundary that has a similar velocity to the phase velocity of the incident wave.This shift is over five orders of magnitude greater than Doppler shifts from solid objects moving with kinematic velocities

• The **Sonic Flashlight**, a device that enables doctors to view ultrasound images directly over the part of a patient's body that is being scanned, is described in an article about the device's inventor, George Stetten, in the December issue of *IEEE Spectrum*. The technique is called real-time tomographic reflection. The image is displayed on a flat-panel screen at one end and reflected by a half-silvered mirror, so that the doctor looks through the mirror and sees the reflected ultrasound image overlaid on the actual area being scanned.

• **Neurons in the primary auditory cortex** are tuned to the intensity and specific frequencies of sounds, but the synaptic mechanisms underlying this tuning remain uncertain. However, whole-cell recordings *in vivo* help to disentangle the roles of excitatory and inhibitory activity in the tone-evoked responses of single neurons in the auditory cortex, according to a Letter in the 27 November issue of *Nature*. The excitatory and inhibitory receptive fields cover almost exactly the same areas, in contrast to the predictions of classical lateral inhibition models.

• Working out at a gym may improve your muscle tone, but both the staff and exercise participants could **damage their ears** from the loud music, according to a note in the October issue of *Physics Today*. At some clubs, sound levels were measured at 120 dB. Since 1991, the American Council on Exercise has published noise level guidelines, but few instructors follow them. Some national fitness club chains hold 45-minute long classes at 110 dB.

• CT scans of fossils are being used to study the **evolution of hearing** according to a paper in the 31 October issue of *Science*. Some researchers even hope to give the fossils "hearing tests" to determine which sound frequencies the living animal might have heard. Although the leap from the anatomy of the ear to hearing is rather large, CT studies of fossils have revealed some interesting results. For example the 400-million-year-old *Ichthyostega* was found to have an ear unlike anything else paleontologists or biologists had seen. The stapes, for example is extremely thin and platelike, as if its owner spent more time in the water than paleontologists had believed.

• In the 1970s two scientists at Cornell University came up with a way to **reduce the sonic boom** from a supersonic plane by spreading the shock wave over a wider area. Now Northrup Grumman has tested the idea with a modified F-5E jet fighter, according to an article in the 27 September issue of *New Scientist*. The team replaced the aircraft's cone-like nose with a bulging design "reminiscent of a pelican's throat." The first results matched the computer models very well. The work could form the basis of a prototype in which the sonic boom could be reduced to 15 pascals, according to the article.

• Herring may communicate by squeezing **noisy bubbles** out of their backsides, according to a note in the 21 November issue of *Science*. Herring are known to make various sounds and have unusually good hearing. Investigators noted that the fish make this particular noise at dusk when they are in the habit of clustering together, suggesting that it has a social function.

• **Noise from aircraft** can be reduced significantly by changing the way the planes come in to land, according to an article in the 24 November issue of *New Scientist*. A consortium that includes Rolls-Royce, MIT, Cambridge University, British Airways, and the UK Civil Aviation Authority found that lining up with the runway as far as 70 kilometers away and making a steady descent can more than halve the acoustic energy that reaches the ground. Presently a continuous descent approach, in which an aircraft begins its final descent about 17 kilometers away from the runway and maintains a descent angle of 3 degrees is used at many airports. But this technique involves significant maneuvering at 4000 feet and below, which can be noisy for people living under that part of the flight path. Beginning the descent at 70 kilometers instead of 17 kilometers can drop the noise level by 3.9 to 6.5 dB. Furthermore the long approach saved nearly 200 kilograms of fuel on each landing.

• Studies in macaque monkeys have indicated that the **primate auditory system** is organized in the form of tonotopic maps, according to a paper in *Neuron* **40**, 859. This means that neighboring neurons on the auditory cortical surface will be responsive to sounds in neighboring frequency bands and provides further evidence for the existence of two tonotopically organized, mirror-symmetric areas in the core of the human auditory cortex.

• "Was sonar responsible for a spate of **whale deaths** after an Atlantic military exercise?" is a question raised in a brief communication in the 9 October issue of *Nature*. Fourteen beaked whales were stranded near the Canary Islands close to the site of an international naval exercise on 24 September 2002. Strandings began about 4 hours after the onset of mid-frequency sonar activity. This communication discusses the post-mortem studies of the whales (see

Scanning the Journals

Acoustics in the News in the Fall 2003 issue of *ECHOES*) in more detail. The livers of these animals were the most consistently affected organ.

• The "**EU Noise Policy** and the Related Research Needs" is discussed in an article in *Acustica/Acta Acustica* **89**, 735-742 (2003). The new EU noise policy and particularly the Directive relating to the Assessment and Management of Environmental Noise has a significat influence on the research and development in the field of noise control. An important part of this R&D is generated for harmonized noise mapping and for assessment of annoyance and sleep disturbance.

• New views of **fossil ears**, aided by CT scans, are helping reveal how extinct animals walked, swam, and flew, and perhaps how they heard, according to a paper in the 31 October issue of *Science*. The paper unveils the first detailed look inside the heads of pterosaurs. However the excitement about inner ears stretches far beyond pterosaurs. The large inner ear and related brain region of these creatures implies aerial prowess and a lowered head.

• The November/December issue of *Acustica/Acta Acustica* features a selection of papers presented at the 6th French Conference on Acoustics held in Lille in April 2002. Four special sessions received large audiences and generated lively exchange: Laser Ultrasonics and Acousto-Optic Interaction; Nonlinear Imaging and Elastography; Musical Acoustics and Nonlinear Phenomena; and Impact of Acoustics on the Environment: Propagation. Selected authors from these sessions were invited to write extended versions of their texts. Two papers deal with **interaction of light and sound**. New techniques of **acoustic imaging** using the nonlinear properties of the propagating medium are discussed in the next two papers. Two papers focus on the **physical modeling of musical instruments** involving nonlinearities, while two papers deal with **outdoor sound propagation**.

Richard Bolt, who recieved the Gold Medal at the 50th anniversary meeting at MIT in June 1979.

Gabriel Weinreich (with his daughter) at the special session held in his honor at the Austin meeting.

Acoustics in the News

• Papers presented at the Austin ASA meeting were widely quoted in the daily papers in the USA and Canada, thanks to Ben Stein and his staff at AIP, the lay-language papers posted on the Web, and the World-wide press room.

A story "Hot Sounds from a Cold Trumpet? Cryogenic Theory Falls Flat," for example, which appeared in the Science Times section of the 18 November issue of the *New York Times*, was based on paper 2pMUa6. The acoustical study debunked a popular myth among some trumpet players that cryogenically treating their instruments would improve the tonal quality. Similar stories appeared in the *Boston Herald* (11 November) and on the Canadian Broadcasting Company TV (12 November).

A story "Teaching computers how we sing," which appeared in the *Toronto Star* (16 November), was based on paper 4aSP5. Even babies know how to separate speech from song, so why do computers find it so difficult? Computers have to be trained to extract such features as vibrato and pitch which are more prevalent in singing than in speaking.

The *Albuquerque Journal* (10 November) used paper 3aPA6 as the basis for a story "Scientists Use Sound to Clean" that related how scientists at the Los Alamos National Laboratory are putting sound waves to work for future biodefense applications. Calling their device a "filterless filter," the scientists use sound waves from a cylindrical PZT crystal of lead, zirconate and titanate to concentrate particles and aerosols in an air stream for easy filtering.

The lay language version of paper 2aSC14 "Shifting perceptions of age in voice" was the basis for stories on voice aging in the *Pittsburgh Gazette* (28 October) and the *Los Angeles Times* (October 20). The researchers found that pitch and rate of word delivery gave away a person's age. A person who sounds prematurely old could learn to speak more quickly and lower his or her voice.

Science News (15 November) based its story "Humpty-Dumpty Effect: Acoustically, people resemble large eggs" on paper 2pPA12. Using a sound-based scanning technique to determine the shapes of moving creatures and other objects, it has been found that the human form bounces

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Acoustics in the News

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sound waves as if each person were a huge, elongated chicken egg. This new acoustic portrait of people may aid designers of concerts halls.

- Mysterious low-frequency hums continue to make the daily news. A story in the 4 December issue of the *Chicago Tribune* reported complaints by an 81-year old citizen in Albuquerque, who complained to his Congressman, as well as to scientists at the University of New Mexico and Sandia National Laboratory. There have been reports of hums in England, Scotland, and Australia as well as in the United States.
- The special sound of Stradivarius violins may be due to the climate during which the wood developed, according to an Associated Press story appearing in the 2 December online version of the *New York Times*. A “little ice age” that gripped Europe from the mid-1400s until the mid-1800s slowed tree growth and yielded uncommonly dense Alpine spruce for Stradivari and other famous 17th century Italian violin makers. The ice age reached its coldest point during a 70-year period from 1645-1715 known as the Maunder Minimum, after the 19th century solar astronomer E. W. Maunder, who documented a lack of solar activity during the period. Stradivari was born a year before the Maunder Minimum began.
- “Is There an Echo in Here? Software Lets Architects Predict” is the title of a story in the 30 October issue of the *New York Times*. Architects are creating computer models to simulate the acoustics of a building so clients can hear how it is likely to sound. Auralization technology can forestall acoustics problems while the design can still be modified. The technology of auralization is still far from perfect, however. One problem is the scarcity of anechoic recordings for tests. Recordings of individual voices and instruments are available but few sample choirs. To remedy that situation, the Wenger Corporation arranged to record a choir from St. Olaf College in a large anechoic room at the 3M research center (see report elsewhere in this issue). Recordings of this type are useful as source material for using auralization to predict the acoustics of future concert halls.
- A sound that residents of Sausalito, California hear all summer long has been identified by a marine biologist as the sex call of a toadfish, according to a story in the 18 December issue of the *San Francisco Chronicle*. The constant humming, at a perfect A-flat, was a mystery for years, blamed by on secret experiments by the Army Corps of Engineers, on the local water treatment plant, or even on extraterrestrials. Now scientists have reported that one type of male toadfish has such extraordinary muscular strength above its swim bladder than it can hold its loud droning by vibrating those muscles for more than an hour at a time. Moreover, the toadfish vibrates the muscles at 6000 times a minute, twice the speed of a hummingbird’s wing.

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