

The newsletter of  
The Acoustical Society of America

# ECHOES

Volume 23, Number 4  
Fall 2013

## ASA meets in San Francisco

*I left my heart in San Francisco; High on a hill, it calls to me*

*To be where little cable cars climb halfway to the stars*

*The morning fog may chill the air, I don't care*

The 166th meeting of ASA will take place in San Francisco December 2-6. This will be the third ASA meeting in this historic city by the Bay. Sessions will take place in the Hilton San Francisco Union Square. General chair will be James Phillips, while Roger Schwenke is the technical program chair.

The technical program will include 1127 papers, arranged into 117 sessions. A "Hot Topics" sponsored by the Tutorials Committee will cover the fields of Animal Bioacoustics, Architectural Acoustics, Biomedical Acoustics, and Musical Acoustics. An Undergraduate Research Exposition, a special poster session sponsored by Education in Acoustics, will be a forum for undergraduate students to present their research in acoustics.

On Wednesday at 10:30, W. Jeffrey Elias of the University of Virginia School of Medicine will present a special lecture on "The use of MR-guided high-intensity ultrasound to treat essential tremor." Essential tremor (ET) is a common movement disorder which affects an estimated 3% of the population in the United States.

A tutorial presentation on "Time-Frequency Analysis: Theory and Applications" will be given by Professor Leon Cohen of the City University of New York and Professor Patrick Loughlin of the University of Pittsburgh on Monday, 2 December at 7:00 pm. To partially defray the cost of the lecture, there will be a registration fee of \$15 (by 31 October) or \$25 thereafter. (The fee for students with current ID cards is \$7 and \$12 respectively). Lecture notes at the meeting are guaranteed for those who register by 31 October.

There will be technical tours on Tuesday morning and Thursday afternoon. On Tuesday morning there will be a tour of the Exploratorium, which has recently moved to expanded



Cable car

quarters on Piers 15 and 16 downtown. A bus (\$20) will leave the hotel at 10:00 and return at noon, although some folks may wish to stay for lunch at the Exploratorium. A tour of three venues in the Berkeley Arts District on Thursday afternoon will include the Berkeley Roda Theater, the Freight & Salvage Coffeehouse, and the Comal Restaurant, which has a unique active acoustic system. A bus (\$20) will leave the Hilton at 1:30 and return by 6:00. Participants are also welcome to remain in Berkeley for dinner and to return using the Bay Area Rapid Transit (BART).

The ASA Plenary session will be held Wednesday afternoon, 4 December, where Society awards will be presented and the

newly-elected Fellows will be recognized.

The Technical Committee on Signal Processing in Acoustics will again sponsor a Gallery of Acoustics, a forum in which science meets art. Viewers may vote on the entries, with a cash prize of \$500 going to the winning entry. The Technical Committee on Signal Processing will also sponsor a competition for students to develop novel smartphone apps that use acoustic signal processing. Entries will be judged by guest judges from industry as well as Committee members, and cash prizes of \$1000, \$500, and \$300 will be awarded.

The Society Luncheon on Thursday, sponsored by the College of Fellows, is open to all attendees and their guests (\$30). The Women in Acoustics luncheon will be held on Wednesday. The fee is \$25 (students \$15) for preregistration by October 1 and \$30 (students \$20) at the meeting. Buffet socials with cash bar will be held on Tuesday and Thursday at the Hilton.

Once again the College of Fellows will host the ASA Jam

*continued on page 3*

# We hear that . . .

- **Amar G. Bose**, honorary fellow of ASA, died July 12. He taught acoustics and electrical engineering at MIT for over 45 years, and founded the Bose Corporation, a premier maker of audio equipment. In 2011 he donated the majority of the company to MIT to further acoustics education and research.
- The Audio Engineering Society (AES) recently wrapped its 50th International Conference, its first dedicated specifically to **audio education**. The conference took place July 25-27, 2013, at Middle Tennessee State University in Murfreesboro, Tennessee, where more than 140 educators and industry representatives met to exchange ideas and experiences.
- **Helen Wall Murray** has joined the ASA publications office in West Barnstable. Her duties include manuscript coordination for *POMA* and administrative support for *Acoustics Today*.
- The Association for Research in Otolaryngology has selected **Professor H. Steven Colburn**, Boston University as the 2014 recipient of its Award of Merit, a lifetime achievement award recognizing outstanding contributions to the study of the ear, nose and throat. Colburn is founder and director of the Boston University Hearing Research Center and a leading expert on how the brain's auditory system processes sound.
- **ASA School 2014** will be held 3-4 May 2014 immediately before the ASA spring meeting in Providence. ASA School 2014 will provide opportunities for graduate students and early career acousticians in all areas of acoustics to learn about and discuss a wide variety of topics related to the interdisciplinary acoustical theme Living in the Acoustic Environment. The application form and preliminary program will be available in November on the ASA website ([acousticalsociety.org](http://acousticalsociety.org)).
- **Graeme Clark, Ingeborg Hochmair, and Blake Wilson** were named winners of the Albert and Mary Lasker Foundation's annual clinical prize for their work on cochlear implants. Hochmair and Clark were the first to insert multiple electrodes into the human cochlea to stimu-

late nerves that respond to different frequencies of sound. Wilson later refined the technology with a strategy known as "continuous interleaved sampling" (CIS), which allowed the implants to process speech clearly.

- **Brian Houston** received the Office of Naval Research, Dr. Arthur E. Bisson Prize for Naval Technology Achievement Award, April 24, 2013, for his exceptional technical and engineering leadership in the development, demonstration, and transition of a new broadband underwater mine hunting sonar. ASA Fellow Houston is head of the Physical Acoustics Branch at the Naval Research Laboratory.

## Best Student Paper Awards (Montréal)

### *Acoustical Oceanography*

First: Florian Aulanier, Institut Polytechnique de Grenoble  
Second: Kevin Jerram, University of New Hampshire

### *Animal Bioacoustics*

First: Erickson Neilans, SUNY University at Buffalo  
Second: Allison Hahn, University of Alberta

### *Architectural Acoustics*

First: Timothy Newman, University of Cambridge  
Second: Soenko Pelzer, RWTH Aachen University

### *Biomedical Acoustics*

First: Amin Jafari Sojahrood, Ryerson University  
Second: Grasland-Mongrain Pol, Université de Lyon

### *Engineering Acoustics*

First: Peter McKeon, Georgia Institute of Technology  
Second: Ellen Skow, Georgia Institute of Technology

### *Musical Acoustics*

First: Mossein Mansour, McGill University  
Second: Jiayi Liu, University of Cambridge

### *Speech Communication*

First: James Dias, University of California  
Second: Yoonjeong Lee, University of Southern California

### *Structural Acoustics and Vibration*

First: Matthew Reynolds, University of Southampton  
Second: Luca Alimonti, Université de Sherbrooke

### *Underwater Acoustics*

Lanfranco Muzi, Portland State University  
Mingjie Ding, Tokyo Institute of Technology

## Best Paper by a Young Presenter (Montréal)

### *Noise*

Calum Sharp, University of Salford  
Frederik Nielbo, Aarhus University

### *Signal Processing in Acoustics*

Chuang Shi, Nanyang Technological University, Singapore  
Stewart Holmes, Lloyd's Register ODS, Denmark



## 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.

Echoes Editor . . . . . Thomas Rossing  
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# ASA meets in San Francisco

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Session on Wednesday night. Bring your sax, horn, sticks, voice, or anything else that makes music. Musicians and non-musicians are all welcome to attend. A full PA system, back-line equipment, guitars, bass, keyboard, and drum set will be provided. Attendees will enjoy live music, a cash bar, and all-around good times.

A short course on Array Signal Processing for Sonar will be held Sunday afternoon and Monday morning. The instructor will be Douglas Abraham, who has over twenty years of experience in the sonar field at the U.S.Navy, NATO and university laboratories. The registration fee of \$300 (\$125 for students) covers attendance, instructional materials and coffee breaks. A \$50 discount applies to full registration before 31 October.

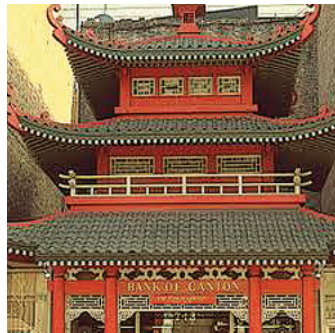
A student transportation fund provides limited funds to students to partially defray transportation expenses to meetings. Students presenting papers who propose to travel in groups using economical ground transportation will be given first priority to receive subsidies. To apply for a subsidy students should submit a proposal by 31 October to Jolene Ehl [jehl@aip.org](mailto:jehl@aip.org). The Committee on Women in Acoustics is sponsoring a Young Investigator Travel Grant to help with travel costs associated with presenting a paper at the meeting. Young professionals who have completed their doctorate in the past five years are eligible to apply if they plan to present a paper at the San Francisco meeting and have not previously received the award. Applicants should submit a copy of the abstract for their presentation and a current resume to Jennifer Miksis-Olds [jfm91@psu.edu](mailto:jfm91@psu.edu) by 21 October. Further details about travel grants appear in the Call for Papers online.

With a full program of interesting papers and events, there won't be much time for sightseeing, but visitors who come early or remain a few days after the meeting will find many attractions in San Francisco and vicinity. Besides Fisherman's Wharf, Chinatown, Civic Center, Golden Gate Park, and the two bridges (Golden Gate Bridge and the Bay Bridge), there are many fine museums (Exploratorium, California Academy of Sciences, deYoung Museum, Legion of Honor, Yerba Buena Center for the Arts, Asian Museum, and Cable Car Museum and Powerhouse, to mention a few). Concert halls near the Hilton include Davies Symphony Hall, the War Memorial Opera House, the Herbst Theatre, and the San Francisco Jazz Center. Out of town are the Zellerbach Concert Hall (Berkeley) and the new Bing Concert Hall (Stanford). Each of San Francisco's famous hills affords spectacular views of the City (Telegraph Hill and Nob Hill are right downtown). The 49-mile drive takes visitors to most of the favorite sights, and several walking tours are described in literature at the Visitors Information Center on Market Street. On the Bay Marina Green (site of the America's Cup Village) offers splendid views of Alcatraz Island.

A custom wine tour of the Sonoma Wine Country has been organized for the Saturday after the conference. A fee of \$97.75 per person includes visits of up to three wineries, transportation, a picnic lunch, cheese and crackers, gratuities, etc. Tasting fees typically cost \$10-\$15 additional, but can often be shared or even waived upon purchase of wine or wine club membership. For further information or to pre-register (required), see [https://www.platypustours.com/custom\\_tour\\_asa.php](https://www.platypustours.com/custom_tour_asa.php).



*deYoung Museum*



*Chinatown*



*Alcatraz*



*Exploratorium*



*The Golden Gate Bridge*



*Fisherman's Wharf*

# ECHOES from Montréal

## Sensory evaluation of concert hall acoustics

Tapio Lokki – [Tapio.Lokki@aalto.fi](mailto:Tapio.Lokki@aalto.fi)

Since the pioneering work of Sabine (1900), scientists have tried to understand why some concert halls sound better than others and what perceptual attributes contribute to the general opinion of extraordinary acoustics. However, subjective and objective comparison of concert halls (Beranek, 2004) is not an easy task since preferred acoustics depend on a number of elements. The music, the conductor, and the performance of the orchestra greatly affect the listening experience, and the contributions of the auditorium acoustics are hard to isolate with subjective surveys.

This article presents the recent studies on concert hall acoustics, in particular subjective studies made with sensory evaluations borrowed from the food and wine industry (Lawless and Heymann, 1999) which shares similar problems with acoustics, such as multidimensional perceptual attributes and matters of personal taste. Sensory evaluation can be performed using *consensus vocabulary* profiling where a group of assessors first elicit the adjectives to describe the stimuli and then with group discussions develop a common vocabulary of consensus attributes. However, more suitable methodology for concert hall acoustics studies is based on *individual vocabulary profiling*, which allows the assessors to employ their own attributes, and thus overcomes the need for assessors to interpret the complex meanings of consensus attributes. The basic premise for the individual approach assumes that there exist common salient characteristics that will be perceived by assessors in a similar manner. For example, the attribute clarity can have several definitions and it cannot be ensured that all assessors would understand and agree upon the meaning and usage of such an attribute scale. But, with individually elicited attributes and their descriptions many aspects of clear and defined sound can be found.

One key issue in rating the samples with sensory evaluation methods is the simultaneous comparison of all samples. Humans can compare wines or sounds quite accurately, but absolute judgments are really hard for us. In the case of concert hall acoustics, it means that assessors should be able to switch between different acoustics, i.e., seats or concert halls in the blink of an eye. This requires recordings of symphony music played with the same orchestra exactly at the same level and tempo in each hall. Even a professional orchestra cannot do this as the players intuitively adjust their playing style according to the acoustics. Therefore, to capture the sound of exactly the same symphony orchestra we have invented a system called a loudspeaker orchestra. It consists of 34 calibrated loudspeakers that are distributed on the stage in the form of a real orchestra as illustrated in Fig. 1. The music reproduced with the loudspeakers was recorded one player at a time in an anechoic chamber. This “symphony orchestra simulator” has been found very useful and the authenticity of reproduced sound with multichannel setup in the laboratory is high.

No spatial sound recording technique that enables authen-



FIGURE 1: The loudspeaker orchestra on the stage of Musikverein, Vienna and the microphone array used to capture spatial impulse responses.

tic reproduction in the laboratory exists. Therefore, we perform spatial sound recordings via impulse responses, captured with multi-microphone techniques, e.g., an array consisting of six omnidirectional microphones in a 3D setup (see Fig. 1). These impulse responses are analyzed with the Spatial Decomposition Method (Tervo et al., 2013) to estimate the direction of incidence of the sound energy at each discrete time instant. Then a monaural impulse response is distributed to a multi-channel spatial sound reproduction system (24 loudspeakers in a 3D setup) for convolution with anechoic music signals. In practice, this is a process that can produce almost authentic spatial sound reproduction of the loudspeaker orchestra playing anechoic music on the stage of the measured concert hall. Moreover, spatial impulse responses can be used to visualize cumulative sound energy in time-frequency and spatiotemporal domains, see Fig. 2.

## RESULTS

The sensory evaluation methods, in particular those based on individually elicited attributes, have been found very useful for studying concert hall acoustics due to their ability to extract

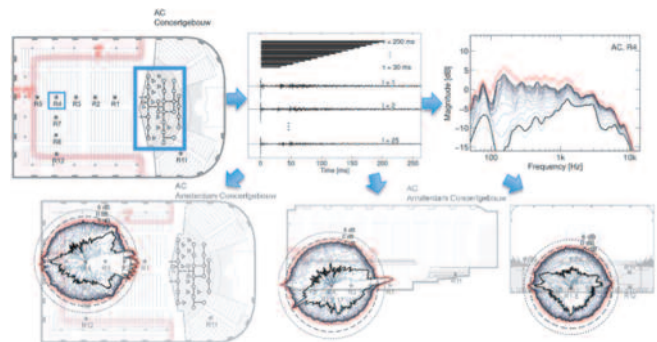


FIGURE 2: The sound energy emitted by a “symphony orchestra simulator” is analyzed from spatial impulse responses at increasing time windows and the results are plotted to visualize how sound field evolves in time, frequency, and spatial domains.

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# ECHOES from Montréal

information often hidden behind preference judgments. First, the evaluation process produces a list of effective perceptual characteristics to identify salient perceptual attributes between the studied halls. Second, ratings with individual attributes can be clustered and sensory profiles of studied concert halls can be formed. Third, the ordering of concert halls is revealed according to the attribute clusters. Finally, if the preference rating is included in the listening test, the preferences could be explained with sensory profiles of halls.

Our recent studies (Lokki et al., 2011 and 2012) have produced large numbers of attributes that describe the differences in acoustics of the studied halls. Some of them are listed in the following table with general preferences:

Main group	Contributing attributes	General preferences
Loudness	Strength, level, intensity, dynamics	The louder the better and large dynamics is essential.
Immersion	Presence, intimacy, envelopment, spaciousness	Engaging and enveloping sound is interesting and desired.
Spatial extent	Distance, depth, source width, balance	Proximate and spatially balanced sound (no image shift) is good.
Definition	Clarity, articulation, blend, discrimination, sharpness	Different instruments should have sharp articulation with a nice blend.
Timbre	Openness, brilliance, balance, warmth, bassiness	Balanced frequency response with small emphasis on bass and enough high frequencies give open and brilliant sound.

To conclude, a concert hall has to support musicians in their work and the acoustics carry the music from the stage to the audience, hopefully with full spectrum and dynamics. Although, the acoustics of a concert hall are heavily a matter of taste, the majority of people seem to prefer the acoustics that renders the sound of an orchestra intimate and close, with good clarity and openness and most important, the

sound has to be loud enough and envelop the listener. To render open sound with large dynamics with full spectrum the concert hall has to create quite strong early lateral reflections with full bandwidth. Finally, the ingredients of engaging sound are large dynamics, proximity, envelopment, flat and rich frequency response and finally slightly emphasized bass to give warmth to the sound.

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Tapio Lokki is an associate professor in the dept. of Media Technology at the Aalto University. He received the ICA Early Career Award 2013 for outstanding contributions to room acoustics, particularly for novel subjective and objective assessment methods of concert halls.

This article is a summary of paper 4aID1, presented at ICA2013 in Montréal.

## ECHOES from SMAC

The fourth Stockholm Music Acoustics Conference (SMAC), held at KTH on July 30 – August 3, was organized jointly with the tenth annual Sound and Music Computing (SMC) conference and RENCON (Music Performance Rendering Contest for Computer). The keynote speakers were Xavier Serra and Mari Tervaniemi. Over 130 oral presentations were made during the week, and over one hundred posters were displayed throughout the venue, three concert evenings of prominent electroacoustic music were presented. From an all-time high of 176 submitted compositions, a jury at the



SMAC City Hall Reception

Royal College of Music selected 30 pieces for presentation in three concerts. Besides the concerts, social events included a welcome reception, a late-night pub of live electroacoustic music, the traditionally splendid reception at the Stockholm City Hall, and a banquet dinner at the Vaxholm fortress. The fortress is a historical location one hour from the city, reached by a sunset boat trip through the scenic archipelago. Acting chairs were Anders Askenfelt for SMAC, Roberto Bresin for SMC, and Anders Friberg for RENCON. Sten Ternström was the General Chair.

# Scanning the journals

Thomas D. Rossing

- A paper in the August issue of *Journal of Speech, Language, and Hearing Research* reports how signal clarity interacts with the use of sentence context information in determining **speech-in-noise recognition** for children with cochlear implants and children with normal hearing. Word recognition in noise improved significantly for both groups of children for high-predictability sentences in clear speech. Children with normal hearing benefited more from each source of information compared with children with cochlear implants.
- An online study of **vowel recognition by English speakers** is reported in the August issue of *Acoustics Australia*. A relatively unused region of the perceptual vowel plane is identified at about  $(F2, F1) = (1800 \text{ Hz}, 350 \text{ Hz})$ . The rest of the plane is divided among vowels that differ somewhat for different countries and regions thereof. Vowel length is used in several cases to help distinguish vowels which overlap in  $(F2, F1)$ . When the fundamental frequency is higher, values of  $F1$  and  $F2$  are also higher. The characteristic separations required to distinguish vowels were 115 Hz and 292 Hz in the  $F1$  and  $F2$  directions respectively, with similar values in different countries.
- An **open source audio recognition program** known as ROS Open-source Audio Recognizer (ROAR) is described in the April issue of *Autonomous Robots*. This program allows robotocists to train machines to respond to a side range of sounds, such as shutting a door or setting off a smartphone alarm.
- By measuring the **speed of sound in argon**, scientists at the National Physical Laboratory in Teddington, UK have measured the Boltzmann constant with the lowest uncertainty yet obtained, according to a paper in *Metrologia* **50**, 354. This leads to a new definition of temperature, which is in keeping with the re-definition of SI units in terms of fundamental constants of nature. The speed of sound was measured in a Cranfield resonator, in which the largest contributor to uncertainty is the uncertainty in the molar mass of atmospheric argon.
- The inner ear contains sensory epithelia that detect head movement, gravity, and sound. However, according to a letter in the 8 August issue of *Nature*, it is unclear how to develop these sensory epithelia from pluripotent stem cells. This letter reports the stepwise **differentiation of inner ear sensory epithelia from mouse embryonic stem cells** in three-dimensional culture. These stem-cell-derived hair cells exhibit functional properties of native hair cells and are structurally and biochemical-ly comparable to developing vestibular end organs.
- **Sound waves can squeeze through holes smaller than their wavelength** in a special wall, according to a paper in *Physical Review Letters* **110**, 244302. To accomplish such extraordinary transmission, pieces of plastic film were stretched across tiny perforations in a thin metal plate, creating a type of metamaterial. Incoming sound waves of a selected frequency resonated with the film, causing air to flow as if it were massless and funnel as much as 97% of the sound through the holes. The sound within the holes was intensified by a factor of up to 5700, and thus could be used in sensitive detectors, the authors suggest.
- A method for **computing the shape of a room from its acoustical echoes** is described in a paper (published online July 10) in *Proceedings of the National Academy of Science*. The shape of a convex polyhedral room is computed from its response to a known sound recorded by several microphones using the properties of Euclidean distance matrices.
- The widespread use of drugs has increased the number of multiresistant bacteria tools that can rapidly detect and characterize bacterial response to antibiotics are much needed in the management of infections. Highly sensitive **atomic force cantilevers** can be used to detect low concentrations of bacteria, characterize their metabolism, and screen their response to antibiotics, according to a paper published online (June 30) in *Nature Nanotechnology*.
- Materials with a negative Poisson's ratio, known as auxetic materials, become fatter in cross section when stretched. A paper published online in *Advanced Materials* describes a proposed 3D soft metamaterial; whose auxetic properties might make it an energy-absorbing **acoustic dampener**. The material has regularly-spaced holes.
- A simple model for **sound production in a hand-clap** appears in the August issue of *Acoustics Australia*. The aerodynamics of the impact between two human hands is examined, particularly in relation to the hand profile, which may be either complementary in the two hands, giving a nominally flat impact, or else domed so that there is a significant enclosed volume. It is shown that shock waves are generated in nearly all hand-claps, with the addition of a Helmholtz-type resonance in the case of domed impacts. As can be judged by simple listening, a flat clap produces broad-band sound that typically extends to about 10 kHz, while the spectrum of a domed clap usually has a maximum somewhere below 1 kHz and then declines with frequency more rapidly than does the flat clap.
- "Researchers can get visibility and connections by **putting their data online**," according to an essay in the 8 August issue of *Nature*. Many researchers agree that public access to raw data would accelerate science—because other scientists might be able to make advances not foreseen by the data producers. Although some journals and funding agencies are now encouraging scientists to make their data public, the fear of being scooped is a powerful inhibitor. Also would-be sharers often worry that their data are too disordered or shoddy to release into the world.
- As a fetus grows inside a mother's belly, **it can hear sounds from the outside world**—and can understand them well enough to retain memories of them after birth, according to new research reported (online August 26) in the *Proceedings of the National Academy of Science*. Once we learn a sound, we form a memory of it, which is activated when we hear the sound again the authors explain. This memory speeds up recognition of sounds in the learner's native language and can be detected as a pattern of brain waves, even in a sleeping baby.

# Acoustics in the News

- Daniel Kish was born with retinal cancer, and to save his life both eyes were removed when he was 13 months old. According to a story in the July issue of *National Geographic*, he has learned to navigate by echolocation like a bat. Making a clicking noise with his tongue, he has become so adept at echolocation that he can ride a bicycle in traffic. His group, World Access for the Blind, teaches others the art of the click.

- The judge in the murder trial of George Zimmerman ruled that prosecution audio experts who identified Trayvon Martin as screaming on a 911 call moments before he was killed wouldn't be allowed to testify at the trial, according to a story in the June 23 issue of the *San Francisco Chronicle*. "There is no evidence to establish that their scientific techniques have been tested and found reliable," the judge said in her ruling.

- Bulk acoustic-wave (BAW) resonators, used in optical networks as well as radar, consist of thin-film layers of piezoelectric and semiconductor materials sandwiched between metal electrodes. Now, according to a story in the June issue of *Laser Focus World*, a wavelength-specific technology called picosecond acoustics not only measures microns-thick bulk layered devices, but also characterizes nanometer-scale thin films. A pump pulse generates an acoustic-strain pulse that is related to absorption (which is very high for metals). The strain pulse propagates in the film at the longitudinal sound velocity of a few nanometers per picosecond, modifying the dielectric constant of the film. A second probe-laser pulse detects these changes.

- Obesity in adolescents has now been associated with hearing loss, according to a story in the June 25 issue of *The New York Times*. The study reported that beginning at or above the 95th percentile for body mass index—the definition of obesity in teenagers—was associated with poorer hearing over all frequencies, and with almost double the risk of low-frequency hearing loss in one ear. It is suggested that inflammation induced by obesity may be a factor in organ damage.

- Using steady streams of sound waves, Swiss researchers maneuvered water droplets through the air, according to a report July 15 in the *Proceedings of the National Academy of Sciences*.

They have also used the touch-free technique to gently handle delicate and hazardous lab chemicals and to avoid contaminating cells in biological experiments. To achieve levitation, they vibrate aluminum blocks about the size of postage stamps up and down, like tiny jackhammers. The rapid buzz kicks up sound waves that sail upward until they hit a Plexiglass reflector and then bounce back down to the blocks. When these falling waves run into the climbing ones, they can cancel out, creating a low-pressure pocket that can support an object's weight. By adjusting vibration rates to control the position of the pocket, the researchers could float particles across a chessboard of the aluminum blocks. The team used the technique to mix droplets of cells with DNA. They also glided a bubble of water into a globule of sodium metal to demonstrate how to safely work with hazardous materials from a distance. When the water struck the metal, the combo exploded, spewing flammable hydrogen gas.

- The July 22 issue of *the institute (IEEE)* has an article about "The History of Hearing Aids." "The telephone, patented by Alexander Graham Bell in 1876, was the first electrical device that could transmit speech. Since the receiver was held up to the ear, some hearing-impaired people found it easier to listen to a conversation on Bell's telephone than listening to someone in person. However, Thomas Edison, who was hard of hearing, did not find the telephone helpful. He later recalled that his inability to hear sounds from the receiver spurred his interest in improving it. This led to his 1878 invention of the carbon transmitter for the phone, which—unlike Bell's device—amplified the electrical signal.

"In 1938, Aurex Corp., an electronics manufacturer in Chicago, developed the first wearable hearing aid. A thin wire was connected to a small earpiece and then to an amplifier-receiver that clipped to the wearer's clothes. The receiver was wired to a battery pack, which strapped to the leg. In the late 1950s, Otariion Electronics, in Chicago, introduced the first hearing aid worn entirely at the ear—the Otariion Listener. The company did this by putting the electronics in the temple

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*Technical Program Organizing Meeting (San Francisco): Michael Stocker (AB), James Phillips (Meeting Chair), Bradley Goodwillier (PA), Benjamin Shafer (SA), James Chambers (PA), Marc Ettlinger (SC), Thomas Matula (BA), Amanda Lind (AA), Keith Johnson (SC), David Chambers (SP), Thomas Rossing (MU and ED), Steven Pettyjohn (NS), Roger Richards (EA), Jeffrey Ballard (SP), Sunil Puria (PP), James Lynch (AO and UW) (Photo by C. Schmid)*



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## Acoustics in the News

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pieces of a pair of eyeglasses. Fully digital models debuted in 1996, and programmable models, which allow for greater flexibility and fine-tuning of the hearing aids according to the patient's needs, became available in 2000."

- The Earth Harp, claimed to be the world's largest musical instrument, is described in the 26 July online edition of *The New York Times*. One or more strings are stretched from a "bridge" on the stage to a distant object(s) and stroked longitudinally with a rosin-coated finger or glove (as we often do on a smaller scale in acoustics lecture demonstrations). The giant instrument has been demonstrated in the Colosseum in Rome, the Space Needle in Seattle, and in old Jerusalem (as shown in the photo in the *NYTimes*). The closer to the bridge the string is excited, the more upper harmonics are heard.

- Sensory processing disorder, which causes children to have trouble absorbing sensory information like sound and touch, is discussed in the July 31 issue of the *San Francisco Chronicle*. Most children with autism show some signs of struggling with sensory processing, but some doctors believe that up to 15 percent of school-aged children in the United States are affected by it. Treatment of sensory processing disorder involves occupational therapy that's designed to reprogram the brain to better absorb sensory information.

- Exhibitions of sound art are slated to open in two museums in New York, according to a story in *The New York Times* (online August 1). The Museum of Modern Art is opening its sonic survey "Soundings: A Contemporary Score," while the Metropolitan Museum will present "Forty Part Motet," an art installation by Janet Cardiff. The MoMA's exhibit will include recordings of bells as well as a grid of 1500 small speakers, each playing a different tone. At the Metropolitan,

the 40 speakers in Cardiff's piece will be installed in a ring, each one transmitting the sound of a single musical part from the choral extravaganza "Spem in Alium," composed around 1570 by Thomas Tallis.

A survey show of sound art called "Soundings: A Contemporary Score" at the Museum of Modern Art in New York includes sculpture, film, and work on paper with audio components, according to a story in the August 9 issue of *The New York Times*. Tristan Perich's "Microtonal Wall" is a 25-foot panel with 1500 tiny loudspeakers, each tuned to a different pitch, while in a piece by Florian Hecker three speakers carry on an electronic conversation between two floors of the museum. Church bells, stock exchange bells, and bicycle bells, all taped in Manhattan, are heard in MoMA's sculpture garden, while large drawings by deaf artist Christine Sun Kim are also scores. Finally a Rube Goldberg installation by Luke Fowler and Toshiya Tsunoda includes stretched piano wires, electric fans and landscape images projected on a loose cloth.

- The "Flushing climb" was born 23 years ago to prevent planes taking off at La Guardia Airport from disturbing fans at Arthur Ashe Stadium during the United States Open. But now, according to a story in the August 25 issue of *The New York Times*, the FAA has quietly approved much more frequent use of a version of the route in which planes, rather than fanning out, fly a narrower, more precise path. This has infuriated residents of Queens living underneath, who contend they had no say in the change and that the noise has become unbearable.

- Charging stations may use ultrasound to transmit power to wireless devices according to a story posted August 17 in *The New York Times* (online). This idea of an undergraduate student has attracted the interest of venture capitalists.