Session 3pAA

Architectural Acoustics: The Technical Committee on Architectural Acoustics Vern O. Knudsen Distinguished Lecture

David Lubman, Cochair
DL Acoustics, 14301 Middletown Ln., Westminster, CA 92683-4514

William J. Cavanaugh, Cochair
Cavanaugh Tocci Assoc., Inc., 327F Boston Post Rd., Sudbury, MA 01776-3027

Chair's Introduction—1:00

Invited Paper

1:05

3pAA1. Aural architecture: The missing link. Barry Blesser (Blesser Assoc., P.O. Box 155, Belmont, MA 02478, bblesser@alum.mit.edu)

While acoustic architecture focuses primarily on the acoustic physics of objects and geometries, aural architecture emphasizes the experience of space in terms of behavior and emotions. Because auditory spatial awareness, which is the basis for aural architecture, depends on a social value system, the role of acoustics varies among individuals and cultures. When evaluating the aural experience of space, two independent phenomena must be simultaneously considered: Space changes our experience of sound and sound changes our experience of space. Sound sources and spatial acoustics are inseparable. This bilateralism creates an interdisciplinary complexity that fuses physical and social sciences. Hearing is a means by which people acquire a sense of where they are, connecting them to dynamic events and spatial geometry. Auditory spatial awareness allows people to sense the elegance of a plush office, the emptiness of an uninhabited house, the depth of a dark cave, the quiet of a city covered in snow, the vastness of a railroad station, and the openness of a beach front. Each of these situations can be described in the language of aural architecture, which includes at least five types of experiential spatiality: navigational, social, aesthetic, symbolic, and musical.

2:05—2:15 Question and Answer
2:15—2:45 Book Signing

WEDNESDAY AFTERNOON, 12 NOVEMBER 2008 LEGENDS 3/4, 2:15 P.M. TO 3:15 P.M.

Session 3pED

Education in Acoustics: Acoustics Education Prize Lecture

Uwe J. Hansen, Chair
Indiana State Univ., Dept. of Physics, Terre Haute, IN 47809

Chair's Introduction—2:15

Invited Paper

2:20

3pED1. From the sublime to the scientific: What musicians and acousticians can learn from each other. Murray Campbell (School of Phys. and Astronomy, Univ. of Edinburgh, Edinburgh EH9 3JZ, UK)

Many university music programs include an acoustics module, often taught by a physicist. At the University of Edinburgh, such a module has existed since the 1850s; taking over this course as a junior lecturer was my introduction to the fascinating world of musical acoustics. It rapidly became clear that a meaningful communication between scientists and musicians required humility and willingness to learn from both sides. This lecture explores aspects of that mutual learning process, focusing on some controversial areas in which the reconciling of scientific and musical viewpoints has not always proceeded in a spirit of humility.

Session 3pID

Interdisciplinary: Hot Topics in Acoustics

David R. Dowling, Chair
Univ. of Michigan, Dept. of Mech. Eng., 1231 Beal Ave., Ann Arbor, MI 48109-2133

Chair's Introduction—1:00

Invited Papers

1:05

3pID1. Hot topics in engineering acoustics. David A. Brown (BTech Acoust. LLC, and Electro-Acoust. Res. Lab., Adv. Tech. Manuf. Ctr. and ECE Dept, Univ. of Massachusetts Dartmouth, 151 Martine St., Fall River, MA 02723)

The maturation of single crystal piezoelectric materials in the past decade has spawned a renewed interest in traditional and new transducer designs for underwater acoustic and medical imaging applications. The engineering of acoustic devices based on piezoelectric crystals began in the first half of the 20th century and was overtaken by developments in ferroelectric ceramic compounds such as barium-titanate and lead-zirconium-titanate (PZT). These materials are now being challenged by engineered relaxor piezoelectric single crystals materials such as lead-magnesium (or zirconium or indium)-niobate-lead-titanate (PMN-PT, PZN-PT, and PIN-PT) in many applications. The new materials have tremendous improvements in piezoelectric properties including electromechanical coupling coefficients exceeding 90%, which can double the power factor bandwidth for underwater projectors, sound speeds that are a factor of 3 lower than PZT that enable compact low frequency sources, and strain levels as high as 1% for high drive and actuator applications. The hot topics related to engineering acoustics involve the development and commercialization of devices based on new and traditional transducer designs that exploit the novel properties of the new crystal materials. Examples of broadband underwater communications transducers, tonpiltz sonar projectors, pressure and pressure-gradient hydrophones, mechanical actuators, and medical devices are presented.

1:25

3pID2. Uncertainty in ocean acoustics. Steven Finette (Acoust. Div. Naval Res. Lab., Washington, DC 20375-5320, steven.finette@nrl.navy.mil)

When modeling ocean-acoustic systems, the environmental information necessary to compute the acoustic field properties is assumed to be accurately specified by various parameters, fields, and boundary conditions. However, in real world applications, these quantities are subject to uncertainties due to our incomplete knowledge of the waveguide environment. This form of uncertainty involves errors that are quite distinct from the numerical errors that can arise when a mathematical model is discretized, implemented on a computer, and solved with finite precision arithmetic. In effect, the environmental uncertainty introduces spurious degrees of freedom into the system. In order to make reliable simulation-based predictions, this uncertainty needs to be quantified and incorporated in the simulation process itself. The idea of embedding uncertainty into the simulation framework and elevating its status to a subject worth studying on its own merits represents a paradigm shift that has stimulated research in several disciplines. This talk will overview recent approaches to this problem in an ocean-acoustic context and give examples of computations that have incorporated environmental uncertainty in the numerical computation of acoustic field properties. [Work supported by the Office of Naval Research.]

1:45

3pID3. Hot topics in physical acoustics. Joseph Gladden, III (Dept. of Phys., Univ. of Mississippi, University, MS 38677, jgladden@phy.olemiss.edu)

The field of physical acoustics touches a broad range of technical areas important to fundamental science and society. This "Hot Topics" presentation will reflect the breadth of this impact by discussing the following three topics: sound waves in the early cosmos, acoustics in slip-stick friction systems, and acoustic metamaterials. The early universe, composed of hot ionized matter, was able to support acoustic waves until the temperature cooled enough to allow the formation of neutral atoms. The imprint of these relic acoustic waves is still evident in the cosmic microwave background and yields new information about key cosmological constants and dark matter. Earthquakes are perhaps the most destructive of natural disasters, as was painfully demonstrated by recent events in China. Studies on the effects of acoustic vibrations in slip-stick friction systems have begun to shed light on triggering mechanisms for earthquakes and may lead to better early warning systems. Metamaterials are man-made materials in which precise geometric arrays of structures are engineered to produce coherent scattering effects on scales much larger than the structures themselves. These systems can exhibit such exotic properties as a negative index of refraction, band gaps, and a negative effective elastic modulus.

Session 3pSC

Speech Communication: A Quantal Transition: Ken Stevens in "Retirement" II

Helen M. Hanseon, Chair
Union College, Electrical and Computer Eng. Dept., 807 Union St., Schenectady, NY 12308

Invited Papers

1:00

3pSC1. Enhancing the left edge: The phonetics of prestopped sonorants in Australian languages. Andrew Butcher (School of Medicine, Flinders Univ., GPO Box 2100, Adelaide SA 5001, Australia, andy.butcher@flinders.edu.au) and Debbie Loakes (Univ. of Melbourne, Parkville, VIC 3010, Australia)

The consonant systems of Australian Aboriginal languages are very similar to one another but very different from those of most other languages of the world. They have unusually few contrasts in manner of articulation and an unusually large number of places of articulation. Previous research has shown that speakers appear to employ a number of strategies to preserve place of articulation distinctions, particularly in intervocalic (coda) consonants. One such strategy is that in vowel + nasal sequences speakers avoid lowering the velum until the latest possible instant, presumably to preserve spectral clarity at the VC boundary. This often results in a brief homorganic oral stop occurring before the nasal. Phonetically prestopped nasals occur in a large number of languages across Australia and have become distinctive phonemes in a number of languages in the center and south. Less well documented is the parallel phenomenon of prestopped laterals, which is taken to be the outcome of a similar coarticulation avoidance strategy. This paper describes the wide distribution and distinctive phonetic characteristics of prestopped nasals and laterals in a number of Australian languages and proposes that both strategies are aimed at the enhancement of the left edge of the sonorant consonant.

1:25

3pSC2. Quantal events generated by the structural and temporal variation of the vocal tract. Brad Story (Dept. of Speech, Lang., and Hearing Sci., Univ. of Arizona, P.O. Box 210071, Tucson, AZ 85721)

For connected speech, the time-varying vocal tract shape can be represented as a consonant superposition function that imposes constrictions and expansions on an underlying vowel substrate at specific points in space and time. The resulting flow of continuous speech sounds is a combination of characteristics of both the vowels and the consonants. A question is how speakers choose specific spatial locations and temporal patterns with which to execute particular consonants. In this study, acoustic sensitivity functions and formant nomograms based on a vocal tract area function model were used to determine the optimal locations for consonantal constrictions. Specifically, these techniques indicate the points within the vocal tract at which the acoustic effect of a constriction, in terms of formant frequency transitions, will rapidly change. These points are suggestive of quantal events that may occur during production of speech. [Work supported by NIH R01-DC04789.]

1:50

3pSC3. Consonant landmarks: Automatic detection and interpretation. Chiyoun Park and Nancy Chen (MIT, 77 Massachusetts Ave., Rm. 36-525, Cambridge, MA 02139)

Consonant landmarks are acoustic discontinuities in the speech signal that correspond to the closures and releases in speech production, and have been proposed as critical elements in speech processing [Stevens (2002)]. The three types of consonant landmarks represent the onset and offset of salient acoustic events: glottal vibration, turbulence noise, and sonorancy (e.g., nonvocalic voicing). While earlier work [Liu, (1996)] evaluated the success of identifying single candidate landmarks of all three types, this work focuses on two tools for evaluating strings of landmark candidates. First, a bigram model representing the physiologically feasible sequences of consonant landmarks is used to evaluate candidate strings. Second, a graphical method is used to identify the regions where the landmarks are reliably detected versus where they are ambiguous. Together these tools substantially improve the performance for landmark detection, identify regions in need of further acoustic analysis, and model the 'grammatical' structure of landmark sequences. Furthermore, the reliable regions in the proposed representation often correspond to structural elements such as lexical stress and word boundaries. Thus, the proposed representation is potentially useful in analyzing speech not only at the phoneme level but also at the word and phrase levels. [This work was supported by NIH/NIDCD DC02978 and T32DC00038.]

2:15

3pSC4. Point process models of distinctive feature landmarks for speech recognition. Aren Jansen and Partha Niyogi (Dept. of Comput. Sci., Univ. of Chicago, 1100 E 58th St., Chicago, IL 60637, aren@cs.uchicago.edu)

Several interrelated strands of research in linguistics, acoustic phonetics, and cognitive neuroscience suggest a host of new directions for the development of end-to-end computational models of speech perception and recognition. Natural candidates for exploration include (i) phonological representations in terms of distinctive features; (ii) nonlinear detectors for distinctive feature landmarks (or any other set of perceptually salient acoustic events), which define a sparse point process representation of the speech signal; (iii) syllable-metered temporal processing and/or syllable-sized integration windows; and (iv) point process models and hierarchical strategies for

recognizing words, syllables, phonemes, and features. A computational framework around these ideas has been developed and has led to phonetic recognition and keyword spotting performance that is competitive with equivalent hidden Markov model-based systems. This framework thus connects a computational platform for benchmarking competing scientific theories with simultaneous advancement toward a viable technological solution to the speech recognition problem.

2:40—2:50 Panel Discussion

WEDNESDAY AFTERNOON, 12 NOVEMBER 2008 GRAND BALLROOM A/B, 3:30 TO 5:30 P.M.

Plenary Session and Awards Ceremony

Mark F. Hamilton, Chair
President, Acoustical Society of America

Business Meeting of the Acoustical Society of America

Motion to approve the Plan of Merger of the Acoustical Society Foundation, Inc. into the Acoustical Society of America, Incorporated

Presentation of Certificates to New Fellows

DAVID A. BERRY
GEORGE A. BISSINGER
JOHN A. FAWCETT
DENNIS M. FREEMAN
BRUCE R. GERRATT
FRANK H. GUENTHER
KEITH R. KLUENDER
YIU W. LAM
MARSHALL LONG
CHRISTIAN LORENZI
BRYAN E. PFINGST
JOE W. POSEY
STUART ROSEN
ARMEN SARVAZYAN
MICHAEL A. STONE
ANN K. SYRDAL
JOE WOLFE

PRESENTATION OF SCIENCE WRITING AWARDS

SCIENCE WRITING IN ACOUSTICS FOR A JOURNALIST

HAZEL MUIR FOR “NOISY NEIGHBOURS” PUBLISHED IN *NEW SCIENTIST MAGAZINE*, AUGUST 2007

SCIENCE WRITING AWARD FOR MEDIA OTHER THAN ARTICLES

KATHLEEN VIGNESS RAPOSA, GAIL SCOWCROFT, CHRISTOPHER KNOWLTON, PETER WORCESTER FOR “DISCOVERY OF SOUND IN THE SEA” WEBSITE

PRESENTATION OF ACOUSTICAL SOCIETY AWARDS

ROSSING PRIZE IN ACOUSTICS EDUCATION TO D. MURRAY CAMPBELL

SILVER MEDAL IN MUSICAL ACOUSTICS TO GABRIEL WEINREICH

SILVER MEDAL IN PHYSICAL ACOUSTICS TO PETER J. WESTERVELT

SILVER MEDAL IN SPEECH COMMUNICATION TO WINIFRED STRANGE

WALLACE CLEMENT SABINE MEDAL TO JOHN S. BRADLEY