ABSTRACTS FOR PRESENTATIONS WITHOUT SUMMARY PAPERS

Plenary

Variability in speech production and consequences for theories of speech perception
Michael Kiefte, School of Human Communication Disorders, Dalhousie University

Our ability to produce and understand speech is most often taken for granted but would otherwise appear to be highly complex processes. A simple vowel such as "ee" in "heed" can be produced in an infinite variety of ways: it can be spoken aloud, whispered, or sung at a number of different pitches and still be understood unambiguously by the casual listener. The processes involved in perceiving this vowel are not very well understood. In fact, the task seems daunting. For example, a vowel sung by a small child at a high pitch bears very little resemblance acoustically to the same vowel whispered by an adult male. Nevertheless, they are perceived as the same speech sound. Human listeners' ability to reliably identify speech sounds in the face of such variability poses a difficult problem for researchers in speech perception. A substantial portion of related research ignores this variability by focusing solely on, for example, speech from a single phonation type (e.g., voiced versus whispered), gender, or dialect. Recent research has found that the problem is further complicated by the role that the acoustic environment plays in speech perception. This talk discusses research that examines variability observed in speech production from the point of view of speaker, dialect, and phonation type with a special emphasis on dialectal variation in Nova Scotia. In addition recent research that attempts to uncover how human listeners identify speech sounds will be described.

Architectural Acoustics

Noise Control Provisions in Canada's Building Codes
J.D. Quirt and T.R.T. Nightingale
National Research Council Canada, Ottawa

In 2005, NRC published the new "objective-based" version of the National Building Code of Canada; provincial and territorial codes based on this model will come into use over the next year. Some comparison with regulations in other countries and with studies of occupant annoyance will provide a frame of reference. This talk will then explain how the Codes have changed in the context of noise control in multi-dwelling buildings, and indicate some further changes possible in the next cycle of revisions (which is already underway). These changes have implications for both the research and standards development community, and for design professionals including acoustical consultants.

Bio-Acoustics

A remotely-piloted acoustic array for studying sperm whale vocal behaviour
Tyler Schulz[1], Luke Rendell[2], and Hal Whitehead[1]
1Department of Biology, Dalhousie University
2Sea Mammal Research Unit, St. Andrew's University

The inability to attribute clicks to individual sperm whales in a social group has limited our understanding of how these animals use clicks and codas in vocal interactions. In an effort to address this problem, an acoustic array consisting of small remotely-piloted vessels (RPVs) was developed to record and localize the vocalizations of individual sperm whales in traveling social clusters. Each RPV, as well as a larger research platform, is equipped with a hydrophone and a global positioning system (GPS) receiver and logger. The acoustic signals from the remotely-piloted vessels are broadcast by FM transmitters and received by radios onboard the research platform where they are digitally recorded in synchrony, thereby allowing subsequent localization. GPS data, including pseudo-range and phase information, are received by low-cost single-frequency GPS receivers, logged to flash memory cards and downloaded after recovery. Once deployed, the vessels can be piloted to establish and maintain favourable array geometry, provided focal animals are not moving too rapidly. Although GPS error is the primary source of error in our localization accuracy, the smoothing of GPS positions over time greatly improves relative receiver positioning. By using this smoothing, calibration trials with sound sources of a known separation distance have revealed accuracy in acoustic localization of up to 0.5 metres, which is more than adequate to distinguish the vocalizations of neighbouring whales. We have deployed the system several times at sea in the Northwest Atlantic and are currently analyzing recordings to localize the social signals of sperm whales.

Estimating the Acoustic Exposure of Marine Mammals to Underwater Noise
Scott Carr[1], and Adam Frankel[2]
1JASCO Research Ltd. and 2Marine Acoustics, Inc

Underwater noise modelling has matured into a reliable tool for predicting the acoustic noise footprints of maritime operations including military training activities, geophysical exploration and production, shipping and marine construction. Given sufficient knowledge of the acousto-physical properties of the water column and the seabed, it is possible to estimate the acoustic transmission loss for individual sound frequencies and hence the overall attenuation of a spectrally described source at any range. In combination with numerical models that provide reliable estimates of the source's acoustic pulse

properties and spatial pattern, wave propagation modelling provides the means to fully characterize the ensonification of an area, allowing the potential impact on the marine animals to be assessed. The prediction of noise level footprints, however, is only a step in the process of estimating the acoustic impacts on marine life. The interaction between the sound and the animal is also influenced by the animal's frequency-dependent auditory sensitivity relative to the frequency content of the sounds to which it is exposed. The degree to which sounds are audible to an animal can be quantified by subtracting the audiogram thresholds, in decibels, from the respective frequency-dependent band levels of the sounds prior to summing the band levels. The degree of impact is also dependent on the behavioural response to the detected noise which may also be modelled. This presentation outlines a new approach for predicting potential noise impacts on inhabitants of the marine environment that meets current and anticipated future regulatory impact criteria.

Comparing cricket ears
Glenn K. Morris
Biology Dept., University of Toronto at Mississauga, Miss. ON, L5L 1C6, Canada

Cricket males make sounds to attract females for mating or to repel rivals. Their ears are on their forelegs, right and left eardrums backed by internal air tubes opening via spiracles on the thorax. Being very small, yet communicating by low-frequency sinusoidal sounds of long wavelength (~4.5 kHz), crickets are unable to fix the position of a distant caller by body-created side to side differences in sound intensity. Instead common field crickets, Gryllus, conduct sound within dedicated internal air tubes, across their body, so that sound waves reach the front and back of each eardrum at different times after travelling different path lengths. Midbody a special tissue spans the trachea and serves to alter phase. As the cricket turns, right and left path lengths change and the changing sound interaction gives usable binaural eardrum differences. More than 3000 cricket species have been named, divided into 11 subfamilies. All these species must have the same localization problem of size relative to wavelength. I am now making a comparative study of the internal waveguides of different representative cricket species and discovering a diversity of adaptive mechanisms. For example, Allonemobius spp. utilize a mid-body chamber with two phase shifters in parallel. I report on the morphology of these tracheal structures whose acoustic function remains obscure.

Comparison of algorithms for the automatic recognition of Balaenopterid whale calls in noisy environment
Xavier Mouy[1], Mohammed Bahoura[2], and Yvan Simard[1]
1-Institut des Sciences de la Mer, Université du Québec à Rimouski & 2- Dépt. de Mathématiques Informatique et Génie, Université du Québec à Rimouski

Automatic recognition of animal calls is a usefull tool for investigating their seasonal distribution, relative abundance and behavior in their natural habitat. The performance of signal processing methods is however dependant of vocalization types (frequency band, time-frequency pattern variability) and environmental characteristics (noise, propagation effects). This paper compares several time-frequency methods for detection and identification of blue (Balaenoptera musculus) and fin whale (Balaenoptera physalus) calls in the St. Lawrence. Three calls of these balaenopterids are regular patterns of stereotypical infrasounds (< 30 Hz) and another one is of a higher-frequency (30–110 Hz), irregular and variable in both frequency and duration (1-5 s). Because of the high traffic, bathymetric and physical characteristics of the St. Lawrence seaway, the majority of calls are polluted by strong low-frequency noise and warped by multipaths. All methods begin with the computation of a high-resolution spectrogram followed by noise removal using image processing technics. Then, the first approach consists in binarizing the spectrogram and computing the coincidence with a binary time-frequency image template, via a 'and' operation. The second approach consists in selecting local maxima for each time steps of the spectrogram and extract frequency contours of the calls using a tracking algorithm. Then, three recognition methods are tested to classify these contours, Dynamic Time Warping (DTW), Vector Quantization (VQ) and discriminant analysis. The methods' performance is tested on representative call series extracted from continuous recordings collected in the area and their relatives advantages and limitations are discussed.

ROCCA: A new tool for real-time acoustic species identification of delphinid whistles
Julie Oswald[1], Shannon Rankin[2], Jay Barlow[2], and Marc Lammers[3]
1- Scripps Institution of Oceanography/JASCO Research Ltd.; 2 - Southwest Fisheries Science Center, National Marine Fisheries Service, NOAA and 3 - Hawaii Institute of Marine Biology

Acoustic species identification studies generally focus on post-processing of field recordings to develop classification algorithms. The ability to identify delphinid vocalizations in real-time would be an asset during shipboard surveys. A new automated system, Real-time Odontocete Call Classification Algorithm (ROCCA), has been developed to allow real-time acoustic species identification in the field. This matlab-based tool automatically extracts 10 variables (beginning, end, minimum and maximum frequencies, duration, slope of the beginning and end sweep, number of inflection points, number of steps, and presence/absence of harmonics) from whistles manually selected from a real-time scrolling spectrograph (ISHMAEL software) and runs classification and regression tree analysis (CART) and discriminant function analysis (DFA) to identify whistles to species. Schools of dolphins are classified based on running tallies of individual whistle classifications. Overall, 46% of schools were correctly classified for seven species and one genus (Tursiops truncatus, Stenella attenuata, S. longirostris, S. coeruleoalba, Steno bredanensis, Delphinus species, Pseudorca crassidens, and Globicephala

macrorhynchus). This new tool provides a method for identifying schools that are difficult to approach and observe, allows species distribution data to be collected when visual efforts are compromised, reduces the bottleneck of post-cruise analysis, and is valuable for processing data collected using sea-floor mounted acoustic recorders.

Hearing Conservation

In-depth Analysis of Workplace Noise Utilizing a Computer-based Process
Gordon Whitehead, Dalhousie University (retired)

Acoustical professionals have long relied on the sound level meter for analyzing noise in the workplace for purposes of hearing conservation. This presenter has been analyzing such noise for intensity, frequency content, duration, and reflection characteristics utilizing (predominantly) a laptop computer and sound analysis software, for the past 8 years. In the non-clean work environment, the noise has been recorded on a digital auditory tape recorder, for subsequent computer analysis. This approach has proven to be less time consuming than traditional methods, and has provided significantly more acoustical information, as well as the potential for "revisiting" the acoustical event after it has occurred. Hazardous noise exposures have been identified that may have remained unidentified using only a sound level meter and/or dosimeter. This computer-based process has improved the quality of the hearing conservation effort. During this presentation, the analysis process will be demonstrated, and examples of noise from various industries thus analyzed will be presented.

HF Acoustics and Communications

High frequency acoustic observations of episodic mixing events in Lunenburg Bay
Douglas J. Schillinger and Alex E. Hay
Dalhousie University

Episodic wind and wave forcing events observed over the 4-year life of the Lunenburg Bay Observing System cause bubble injection at the surface, and sediment resuspension at the seabed. The resulting enhanced concentrations of scatterers in the water column have proved to be readily detectable in the backscatter amplitudes registered by the Acoustic Doppler Profilers at the three buoy nodes, and indicate penetration of bubbles to the bottom, and suspended sediment rising to mid-depth during the stronger forcing events. Acoustic backscatter amplitudes show enhanced scattering over a range of frequencies (0.6 to 5 MHz). Times of enhanced scattering coincide with large variances in the horizontal and vertical components of velocity. Bubble concentrations in the subsurface (top 2 m) and near-surface (4.5m > d > 2m) layers are correlated with the magnitude of local wind speed, while resuspended sediment concentrations are correlated with significant wave height. Spectra of the near-bottom vertical velocity (H=0.25m) have slopes of -5/3 during periods of high near bottom backscatter indicating that turbulence plays a role in the resuspension of sediment. Backscatter profiles show 2 minute duration bubble plumes extending to 5-10 m depth. Preliminary investigation of these plumes using data from each of the ADPs three beams is consistent with the advection of Langmuir cells over the instrument. The depth of the 70 dB contour, used to demarcate the boundary of these plumes, shows that the depth of penetration of bubbles is related to wind speed. Comparisons of the depth of enhanced scattering to predicted depths of a turbulent dissipation layer shows that turbulent dissipation contributes to the vertical distribution of bubbles.

High-frequency acoustic imaging of bio-degradation of wave-formed sand ripples on the inner continental shelf
Alex E. Hay
Department of Oceanography, Dalhousie University

Continuous in situ observations of orbital-scale sand ripple degradation were made during the Sediment Acoustics Experiment (SAX04) in 15-m water depth on the inner shelf of the Gulf of Mexico following Tropical Storm Mathew in October 2004. The dominant ripple wavelength was 50-60 cm. The sand median grain size was 350 microns. Bed elevation profiles and planform images of the ripple field were obtained at cm-resolution using rotary sonars operating primarily at 2.25 MHz. Tidal and other low-frequency currents, wave orbital velocities, and nearbed turbulence were monitored simultaneously with co-located instruments. Over the 20-d duration of the record, the variance in the primary ripple band decayed by a factor of 10. In contrast, the variance at high spatial frequencies remained nearly constant. Physical forcing in the nearbed region was relatively weak (rms wave orbital velocities ~ 5 cm/s), but non-negligible (turbulent kinetic energy dissipation rates ~ 10-6 W/m2). The dominant mechanism driving ripple decay was biological: specifically, pitting of the seabed by fish. The observed rates of decay the bed roughness spectrum and azimuthally-integrated backscatter amplitudes are compared to models constructed from diffusive dissipation of small-scale roughness.

Music Cognition and Musical Acoustics

Agerian music: Genre classification
Lamya Fergani and Amrane Houacine
Informatic and Electronic Faculty of Algiers, Algeria

Searching and organizing growing musical collections for the Algerian radio requires classifying the music signals into a hierarchy of genres to structure them. Musical genres are defined as categorical labels that auditors use to characterize pieces of music. So, a musical genre can be characterized by a set of common perceptive parameters shared by its members. These perceptive parameters are closely related to the instrumentation, rhythmic structure and also harmonic content of the music. An automatic genre classification would actually be very helpful to replace or complete human genre annotation,

which is actually used. In this paper, we explore the automatic genre classification of a musical Algerian database. More specifically, two feature sets composed of signal objective descriptors and which are closely related to perceptive ones (timber, rhythm) are proposed. The automatic classification of this database is then evaluated through three classifiers: K-nearest neighbors, Gaussian mixture models and neural networks. We thus obtain scores of 60% to 80% for eight genres. Interesting comparative results are reported and commented. Index Terms— audio classification, feature extraction, musical genre classification, music information retrieval

Noise Control

Atténuation effective apportée par l'utilisation d'une double protection auditive
Jérémie Voix[1], Frédéric Laville[1], and Hugues Nélisse[2]
1 - Département de génie mécanique, École de technologie supérieure, Montréal (QC), & 2 - Institut de recherche Robert Sauvé en santé et sécurité du travail, Montréal (QC)

Cette étude vise l'évaluation de l'atténuation effective de la double protection auditive portée par des travailleurs en milieu extrêmement bruyant. La procédure de mesure utilisée découle des travaux de recherche en cours à l'ÉTS en collaboration avec l'IRSST, le Conseil de recherche en sciences naturelles et en génie du Canada (CRSNG) et la compagnie SONOMAX. Il s'agit de mesurer le niveau de pression acoustique dans le canal auditif, entre le bouchon et la coquille et à l'extérieur de la coquille et d'estimer à partir de ces mesures l'atténuation effective de la double protection et aussi de chaque protecteur. Les enregistrements ont été effectués au cours d'une même journée de travail sur l'ensemble des travailleurs pendant des durées de l'ordre de cinq minutes sur plusieurs périodes de travail représentatives de diverses conditions de travail rencontrés. Les enregistrements ont été analysés par la suite en laboratoire pour déterminer les niveaux d'exposition ainsi que l'atténuation effective par bande d'octave et en valeur global pondérée A pour les différentes situations de travail mesurées. Les conclusions de l'étude, similaires à d'autres, font apparaître des performances des coquilles grandement diminuées en présences de fuites acoustiques (cheveux, branches de lunettes de sécurité, etc.), mais ouvrent également des pistes intéressantes pour l'étude de l'efficacité en temps réel des bouchons d'oreille.

CSA Z107.10 Acoustical Standards in Canada
Cameron Sherry
Les Consultants LBCD Inc.

Why did the CSA Z107 committee decide that there should be a Canadian acoustical standard, Z107.10. There are many acoustical standards available within the world but which ones should be used and which should not? If we use an acoustical standard are there any limitations? What terms should we use when talking or writing about acoustics and how are they defined? The answers to some of these questions should be apparent in this paper and the ones that follow.

Exact acoustical analysis of sound radiation from free vibration of rectangular Mindlin plates
Korosh Khorshidi, Shahrokh Hosseini-Hashemi, and Ali Sadeghi
Iran University of Sceince and Technology (IUST)

In this study, acoustic radiation of a Mindlin rectangular plate was investigated. The boundary condition of the plate is simply supported (S-S-S-S).The variational method was utilized to formulate plate vibration. Meanwhile it was assumed that no fluid loading occurs in the structure. The dimensionless equations of motion was derived based on the Mindlin plate theory to study the transverse vibration of moderately thick rectangular plates (in terms of the stress resultant with consideration of transverse shear deformation and rotatory inertia) without any approximate method (S. Hosseini-Hashemi et. al. (2005)). Incorporating structural-acoustic coupling was implemented for vibrating plate models. The radiation field of a plate vibrating with a specified distribution of velocity on the surface can be computed by Rayleigh integral. In the present work, the acoustic pressure distribution of the radiator was analytically obtained in its far field. Numerical results were presented for a wide range of aspect ratio and thickness ratio and their effects on the sound pressure were studied in more detail. It is worth noting that this theory and its results can be applied for thin plates. S.H.Hashemi, M.Arsanjani, 2005" Exact characteristic equations for some of classical boundary conditions of vibrating moderately thick rectangular plates", International Journal of Solid and Structures, v 42, 819-853.

Physical Acoustics/Ultrasound

An environmental noise impact assessment and forecasting tool for military training activities
Scott Carr, Rob Racca, and Dave Hannay
JASCO Research Ltd.

When military training activities are to be undertaken near populated or ecologically sensitive areas, reliable forecasting of the associated sound levels is often necessary to allow effective noise management planning and to satisfy permitting requirements. The Impulse Noise Propagation Model (INPM) was developed by JASCO as an environmental impact assessment and forecasting tool for military training activities. The package models airborne noise from impulsive sources including on-land explosions, underwater detonations transmitted to air, weapons firing (from small arms to artillery) and shock waves from supersonic shells in flight. INPM enables the estimation of aggregate noise levels from complex operations involving multiple concurrent activities. The location, time period and repetition rate of each activity are user specifiable. The current or forecast atmospheric conditions are automatically imported. The software's architecture includes a specially adapted Parabolic Equation propagation model, an expandable database of measured or computed spectral source

levels from a wide range of activities, a run module that coordinates modelling and summing of sound from multiple sources, and a GIS interface for the definition of operational layouts and the display of noise level contours on area maps. The software computes a variety of metrics commonly used in impact assessment including Leq, Ldn and LAFmax for impulsive noise, based on broadband levels calculated from modelled results in individual frequency bands. Tabular reports of noise levels at any number of receiver locations and modelled times can be automatically sent to e-mail accounts or wireless devices. This presentation will provide an overview of the INPM software and its use at Canadian Forces bases.

Magnetic Resonance Imaging of Acoustic Streaming in Gases
Ben Newling, Duncan MacLean, and Igor Mastikhin, University of New Brunswick

Acoustic streaming (AS) is a time-independent fluid motion generated by a sound field. Rayleigh acoustic streaming, first described by Lord Rayleigh, is circular flow from node to antinode that occurs when a standing wave is set up inside an enclosure. In gases, the AS dynamics can be extraordinarily sensitive. Conventional measurement methods, such as particle imaging velocimetry, are prone to perturbing the flow field. Magnetic resonance imaging (MRI) offers the possibility of non-invasively obtaining three-dimensional quantification of advective velocity and mechanical dispersion of a gas during acoustic streaming. MRI is well-established as a powerful clinical tool, but MRI measurements in a gas are more difficult than in a patient. The density of MRI-active nuclei is ~1000 times lower and MRI signal durations are often two or three orders of magnitude shorter in a gas than in a person. Unconventional MRI methods, some of which were developed at the UNB MRI Centre, are required. We have tested several MRI methods for the detection of acoustic streaming in gases. Detection of slow gas motion caused by sound pressure is possible within reasonable acquisition time (minutes). The acquired spatially-resolved velocity spectra show the expected velocity distributions for the case of developed Rayleigh streaming.

Dynamics of the sonoluminescing bubble
Borko Djurkovic, Igor Mastikhin, and Dennis Tokaryk, University of New Brunswick

When bubbles suspended in a fluid are exposed to high power sound pressure, they begin to emit light. This phenomenon is termed sonoluminescence. The study of a single light emitting bubble, known as Single Bubble Sonoluminescence (SBSL), can provide us with a better and more controlled method to study sonoluminescence in an attempt to explain many of its interesting and unique characteristics. To produce SBSL, a sinusoidal ultrasound signal is applied to a water-filled flask at its resonant frequency. The pressure gradient across the bubble forces it towards the pressure antinode. The bubble undergoes nonlinear radial oscillations caused by the pressure swings of the acoustic field. During the compression phase, the bubble experiences violent collapse which results in an emission of light with spectrum that is continuous into the ultraviolet region. The maximum of the spectrum is still unknown due to the absorption of light by water in this spectral region. In our work, we have discovered that by introducing a sinusoidal modulation to the amplitude of the acoustic signal, it is possible to control the bubble motion. Such control can be used to estimate effects of other physical fields on the conditions inside the bubble. We will compare experimental measurements of bubble motion to numerical simulations.

Molecular dynamics simulation of the response of a gas to a spherical piston: Implications for sonoluminescence
Steven Ruuth[1], Alexander Bass[2], Seth Putterman[2], and Barry Merriman[2]
1 - Simon Fraser University & 2 - UCLA

Sonoluminescence is the phenomena of light emission from a collapsing gas bubble in a liquid. Theoretical explanations of this extreme energy focusing are controversial and difficult to validate experimentally. In this talk hard sphere molecular dynamics simulations of the collapsing gas bubble are used to clarify the energy focusing mechanism, and determine physical parameters that restrict theories of the light emitting mechanism. Our model shows strong energy focusing within the bubble, including the formation of shocks and strong ionization. Our calculations show that the gas-liquid boundary interaction has a strong effect on the internal gas dynamics, and that the gas passes through states where the mean free path is greater than the characteristic distance over which the temperature varies.

Spatially resolved NMR relaxation of cavitating liquid
Igor Mastikhin and Benedict Newling, Physics Department, University of New Brunswick

Information on processes in the boundary layer of cavitating bubbles is very important for a better understanding of the phenomenon of cavitation. The boundary layer regulates delivery of reaction products into the bulk and limits gas exchange between cavitating gaseous bubbles and the surrounding liquid. Obtaining information on boundary layers is remarkably difficult. In this work, we attempt to get access to such information by using nuclear magnetic resonance relaxation measurements of cavitating liquid. Nuclei can serve as tiny sensors sensitive to changes in their molecular environment such as a presence of paramagnetic particles, hot temperature and microflows. Measurements were performed both for the liquid phase and for a dissolved gas: a fluorinated gas was dissolved in water prior to the experiment, and its relaxation parameters were recorded.

Speech and Hearing Sciences

An acoustic study of the African Nova-Scotian English vowel systems in North Preston and North Halifax
Melissa Moloissa, Michael Kiefte, and Elizabeth Kay-Raining Bird, Dalhousie University

An acoustic study of the African Nova-Scotian English vowel systems in North Preston and North Halifax Melissa Moloissa, Michael Kiefte, Ph.D., Elizabeth Kay-Raining Bird, Ph.D. The English dialect spoken by African Nova Scotians (ANSE) has never been described phonetically or acoustically despite the fact that it is very distinct from other dialects spoken in Canada. This paper presents a comparative acoustic analysis of the vowel systems of ANSE spoken in two communities of Nova Scotia: North Preston and North Halifax. The distinctiveness of both dialects can be traced back to African-American ancestry, post-slavery settlement history, the long-standing geographical isolation of African Nova Scotian settlements, and social segregation from mainstream Nova Scotia (Grant, 2002; Poplack & Tagliamonte, 2001). It has also been suggested that ANSE retains some features from early African American English (Poplack & Tagliamonte, 2001). Eleven vowels were sampled from 12 speakers from each community. Samples were obtained via the following tasks: a vowel elicitation task that targets the production of each vowel within seven phonetic CVC contexts (/h_d/, /h_t/, /h_l/, /h_nd/, /h_g/, and /d_d/); a reading of a phonetically-balanced text; and a monologue. Frequency values were measured for f0, F1, F2, and F3 as well as formant transitions for all vowels.

Objective Speech Quality Evaluation Using Markov Chain Monte Carlo Methods
Guo Chen and Vijay Parsa
University of Western Ontario

Objective Speech quality evaluation is highly desirable and beneficial in the field of speech processing. A key issue in objective speech quality evaluation is the determination of the relationship between the extracted features and the subjective quality scores. Typically, an optimal regression model is expected to perform this mapping and the order (hence complexity) of the regression model is highly dependent on the number of training samples, amount of noise in the samples and the complexity of the underlying function being estimated. Choosing a model with the right complexity is a challenging problem as a model with low complexity will not accurately model the underlying relationship and a model with a high complexity will result in over-fitting. In this study we investigated a Bayesian evaluation method using Markov chain Monte Carlo (MCMC) sampling, which elegantly handles the model complexity problem. In the proposed method the loudness patterns extracted from the speech signals are employed as the speech quality features. The speech quality is predicted using the Bayesian linear model and MCMC sampling. The unknown degree of freedom of the regression model is handled by defining non-informative priors for the parameters that determine the model complexity, and the resulting quality estimation is averaged over all model complexities weighted by their posterior probability given the data samples. The effectiveness of the proposed method is demonstrated through comparisons with the current standardized speech quality metric (ITU-T P.862) using seven subjective speech quality databases of the ITU-T P-series Supplementary 23.

Pitch perception of young cochlear implant users and normal hearing peers
Amy McKinnon and Michael Kiefte
School of Human Communication Disorders, Dalhousie University

Research in pitch perception by cochlear implant users has focused primarily on post-lingually deafened adults. Little is currently known regarding the pitch perception abilities of those who are implanted at a very early age, yet many children receive cochlear implants when they are less than two years old. Given the effects of brain plasticity early in life, it is conceivable that pitch perception by early cochlear implant users may be much better than that of their older counterparts. This study examines pitch discrimination thresholds of young cochlear-implant users between the ages of 4 and 16. A two-alternative forced choice design is used to determine difference limens at three referent tones: 100 Hz, 200 Hz and 400 Hz. Stimuli consist of speech-shaped complex periodic tones with -6 dB/octave roll-off. Two different tasks are employed: pitch-discrimination, which asks whether two stimuli are same or different, and pitch ranking in which participants determine which of two stimuli is higher in pitch. Normal hearing matches are tested to control for maturational effects, and adult cochlear implant users are also tested to compare findings with other studies. Possible implications for age of implantation will be discussed. [This research is funded by the Nova Scotia Health Research Foundation]

Making young ears old (and old ears even older): Simulating a loss of synchrony
Ewen MacDonald[1], Kathy Pichora-Fuller[2], Bruce Schneider[2], and Willy Wong[1]
1 - Institute of Biomaterials and Biomedical Engineering, University of Toronto, 2 - Department of Psychology, University of Toronto at Mississauga

Age-related changes in the auditory system have been attributed to three independent factors: OHC damage, changes in endocochlear potentials, and loss of neural synchrony. While loss of neural synchrony has little effect on audiometric thresholds, it is thought to contribute to difficulties understanding speech in noise. Young and old adults with good audiograms in the speech range were presented with SPIN-R sentences in two SNR and three processing conditions: intact, jitter, and smear. The parameters of the jittering algorithm were chosen to simulate a loss of synchrony consistent with

prior psychoacoustic and speech experiments on auditory aging. The parameters of smearing algorithm were chosen to match the spectral distortion produced by jitter algorithm. For both age groups, the jitter condition resulted in a significant decline in word identification. However, the smear condition resulted in a significant decline only for the older age group but the decline was not a large as that in the jitter condition. Since a difference in performance between jitter and smear must be due to phase distortion (i.e. a simulated loss of synchrony), the results for both age groups suggest that a loss of synchrony can have a deleterious affect on speech intelligibility in noise. Furthermore, the performance of the young in the jitter conditions was similar to that of the older adults in the intact conditions for low context sentences. Thus, the jitter condition appears to simulate this neural aspect of auditory aging in healthy young ears.

Underwater Acoustics

A Preliminary Study on the Geoacoustic Parameters of Gassy Sediments in St. Margaret's Bay, Nova Scotia

Marie-Noël R. Matthews, Francine Desharnais, David J. Thomson, Gordon R. Ebbeson, and Garry J. Heard, DRCD Atlantic

The St. Margaret's Bay environment is characterized by a superficial layer of gassy sediment in the deepest area of the bay. The effect of this layer on the propagation of sound at low frequencies (below 500 Hz) has been shown to be important, influencing results from localization algorithms that rely heavily on accurate predictions of transmission loss (TL). Since the 1970's, major progress has been made in understanding the effect of gassy sediment on the acoustic field. However, the literature concentrates almost exclusively on the effect of gas at high frequencies. Very little has been published on the comparison between theory and in situ measurements of the geoacoustic parameters at frequencies below 1 kHz. This preliminary study on gassy sediment compares measured and predicted TL versus range to estimate the geoacoustic parameters of the sediment layers in St. Margaret's Bay. The TL measurements were calculated from recordings of underwater narrowband sources on a vertical line array deployed in St. Margaret's Bay. The predicted TL were obtained with a parabolic equation propagation model. Estimated values of compressional and shear speed, attenuation, density and layer thickness are presented for the gassy layer and compared to the theoretical values. This preliminary study reveals that some of the estimated geoacoustic values, such as compressional sound speed, are higher than predicted by the theory.

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Your cost of the instrument will be manufacturers list price.
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