2pPP31. Factors influencing the auditory and cross-modal attentional blink. Adelbert W. Bronkhorst, Marieke van der Hoeven (TNO Human Factors, Kampweg 5, 3769 DE Soesterberg, The Netherlands, adelbert.bronkhorst@tno.nl), Jan Theeuwes, Erik van der Burg, and Thomas Koelewijn (Vrije Univ., 1081 BT Amsterdam, The Netherlands)

When an observer has to report two targets (T1 and T2) embedded in a stream of distracters, an attentional blink can occur. This is the degradation in performance for T2 when T1 and T2 are presented sufficiently close in time (within about 500 ms). The attentional blink paradigm has been extensively used within the visual domain as a tool to study bottlenecks in the processing of sensory information. Several studies have shown that an attentional blink can also occur during auditory or cross-modal presentation. However, these blinks are smaller and more stimulus dependent than visual blinks. In our research we have found a robust blink when T1 and T2 are tones embedded in distracters tones, but no blink when T2 is replaced by a visually presented letter among different distracter letters. The cross-modal blink is also absent when both T1 and T2 are digits. We do find a clear cross-modal blink when a visual T1 with increased difficulty (three letters or a word) is combined with a T2 consisting of a spoken letter. Our results indicate that there are modality-specific as well as amodal bottlenecks and that the latter occur when stimuli are processed on a verbal or semantic level.

2pPP32. Reproducible maskers reveal similar mechanisms predicting multiple-burst-same and multiple-burst-different informational masking conditions. Robert H. Gilkey (Wright State Univ., Dayton, OH 45435), Christine R. Mason, and Gerald Kidd, Jr. (Boston Univ., Boston, MA 02215)

Gilkey, Mason, and Kidd [J. Acoust. Soc. Am. 109, 2468 (2001)] found that although informational masking has typically been thought to depend more strongly on the variability in the ensemble of masking stimuli presented across trials, trial-by-trial performance was strongly related to the specific masker waveform presented on each trial. Moreover, hit and false-alarm rates to individual masker stimuli under multiple-burst-same (MBS) conditions were well predicted by the patterns of energy in those stimuli. Hit and false-alarm rates under the multiple-burst-different (MBD) condition were more difficult to predict. This paper reports on further efforts to model those data. The results indicate that performance under both MBS and MBD conditions can be predicted using a linear combination of envelope statistics computed from seven narrow frequency bands surrounding the 1000-Hz signal frequency. MBS responses are related to the average height of the envelope in these bands and MBD responses are related to the standard deviations of the envelopes. [Work supported by NIH/NIDCD.]

2pPP33. The application of the equal energy hypothesis (EEH) to interrupted, intermittent, and time-varying non-Gaussian noise exposures. Roger P. Hamernik, Wei Qiu, and Robert I. Davis (Auditory Res. Lab., State Univ. of New York at Plattsburgh, 101 Broad St., Plattsburgh, NY 12901)

Industrial data and animal research show that non-Gaussian (nonG) noise exposures are more hazardous to hearing than energy equivalent Gaussian (G) exposures. A statistical metric, kurtosis $[b(t)]$, was shown to order the severity of noise-induced trauma following a nonG exposure relative to an energy and spectrally equivalent G exposure. Four groups of chinchillas were exposed to one of four different nonG interrupted, intermittent, and time-varying (IITV) noise paradigms over 19 days at an Leq=103 dB(A) SPL, with $b(t)$=25 or 50. Each daily exposure consisted of two 4.25-h periods with an hour break. Each 4.25-h exposure was interrupted for 15 min and each 5-day sequence was separated by a 2-day break. Each daily IITV exposure followed one of two different SPL temporal patterns that varied between 90 and 108 dB(A). All IITV exposures produced a toughening effect that did not alter the degree of noise-induced trauma. NonG noise produced as much trauma as a G exposure at 110 dB.

Despite very different temporal patterns for the $b(t)$=50 exposures, trauma was the same. Thus within a common class [i.e., the same Leq and $b(t)$] of nonG, IITV exposure, the EEH may apply. [Work supported by NIOSH.]

2pPP34. The application of statistical learning models to the prediction of noise-induced hearing loss. Wei Qiu, Jun Ye, and Roger P. Hamernik (Auditory Res. Lab., State Univ. of New York at Plattsburgh, 101 Broad St., Plattsburgh, NY 12901)

Three powerful nonlinear statistical algorithms [a support vector machine (SVM), radial basis function network (RBFN), and regression tree] were used to build prediction models for noise-induced hearing loss (NIHL). The models were developed from an animal (chinchilla) database consisting of 322 animals exposed to 30 Gaussian and non-Gaussian noise conditions. The inputs for the models were either energy or energy plus kurtosis. The models predict inner hair cell (IHC) loss, outer hair cell (OHC) loss, and postexposure threshold shift (PTS) at 0.5, 1, 2, 4, and 8 kHz. The models incorporating both energy and kurtosis improved the prediction performance significantly. The average performance improvement for the prediction of IHC loss was as much as 55%, for OHC loss it was 66% and for PTS, 61%. The prediction accuracy of SVM and RBFN with energy plus kurtosis for all three outputs (predictions) was more than 90% while for the regression tree model it was more than 85%. Energy is not a sufficient metric to predict hearing trauma from complex (non-Gaussian) noise exposure. A kurtosis metric may be necessary for the prediction of NIHL. [Research supported by NIOSH.]

2pPP35. The development of models for the prediction of noise-induced hearing loss. Wei Qiu, Jun Ye, and Roger P. Hamernik (Auditory Res. Lab., State Univ. of New York at Plattsburgh, 101 Broad St., Plattsburgh, NY 12901)

Three statistical learning models were developed to predict noise-induced hearing loss (NIHL) from an archive of animal noise exposure data, which contains 936 chinchillas exposed to various noise environments. The following models were constructed: (i) A support vector machine model with a nonlinear radial basis function kernel, (ii) A multilayer perceptron network model and (iii) a radial basis function network model. In addition to frequency-specific energy metrics, noise exposure parameters and biological metrics such as kurtosis, noise type, and pre/postexposure hearing thresholds were used as inputs to the model. There were several indices of auditory trauma at specific audiometric test frequencies that were to be predicted by the models: e.g., noise-induced permanent threshold shift, percent outer hair cell loss, and percent inner hair cell loss. The average prediction accuracy for the three models was better than 80%. These results demonstrate the feasibility of developing such models for the prediction of NIHL in humans. [Research supported by NIOSH.]

2pPP36. Noise-induced hearing loss from non-Gaussian equal energy exposures. Robert I. Davis, Wei Qiu, and Roger P. Hamernik (Auditory Res. Lab., State Univ. of New York at Plattsburgh, 101 Broad St., Plattsburgh, NY 12901)

Data from several different exposures [Hamernik et al., J. Acoust. Soc. Am. 114, 386–395 (2003)] showed that, for equivalent energy [Leq = 100 dB(A)] and spectra, exposure to a continuous, non-Gaussian (nonG) noise produces greater hearing and sensory cell loss in the chinchilla than a Gaussian (G) noise. The statistical metric, kurtosis, could order the extent of the trauma. We extend these results to Leq=90 and 110 dB(A), non-Gaussian noises generated using broadband noise bursts, and band-limited impacts within a continuous G background noise. Data from nine new experimental groups with 11 or 12 chinchillas/group will be presented. Evoked response audiometry established hearing thresholds and surface preparation histology quantified sensory cell loss. There were clear

intensity-related effects. At the lowest levels there were no differences in the trauma produced by G and nonG exposures. At Leq=90 dB(A). nonG exposures produced increased trauma relative to equivalent G exposures. By removing energy from the impulsive transients by limiting their bandwidth, trauma could be reduced. The use of noise bursts to produce the nonG noise also reduced the amount of trauma. A metric based on kurtosis and energy may be useful in modifying existing exposure criteria. [Work supported by NIOSH.]

2pPP37. The application of the equal energy hypothesis (EEH) to interrupted, intermittent and time-varying Gaussian noise exposures. Wei Qiu, Roger P. Hamernik, and Robert I. Davis (Auditory Res. Lab., State Univ. of New York at Plattsburgh, 101 Broad St., Plattsburgh, NY 12901)

Interrupted, intermittent, time-varying (IITV) noise exposures may reduce the susceptibility of the cochlea to hearing loss through toughening or conditioning effects. Six groups of chinchillas were exposed to a broadband Gaussian IITV noise over the course of 19 days at an Leq=101 or 106 dB(A) SPL. All exposures at a given Leq had the same total energy. Each daily exposure consisted of two 4.25-h periods with an hour break in between. Each 4.25-h exposure was interrupted for 15 min and each 5-day sequence was separated by a 2-day break. Daily IITV exposures at 101 dB varied between 90 and 108 dB(A), while those at 106 dB(A) varied between 80 and 115 dB(A). For the IITV exposures three different variations in the SPL temporal profile were used. Five-day continuous, equal energy exposures at 100 or 106 dB(A) SPL served as control conditions. The IITV exposures produced up to 40 dB toughening that did not have any effect on thresholds or sensory cell losses. There were some differences in the permanent threshold shift and cell loss across equal energy exposures but the differences were small. The EEH may be valid for Gaussian IITV exposures. [Work supported by NIOSH.]

2pPP38. Temporal characteristics of extraction of size information in speech sounds. Chihiro Takeshima (Grad. School of Music, Kyoto City Univ. of Arts, Kyoto 610-1197, Japan, ctakeshima@yahoo.co.jp), Minoru Tsuzaki (Kyoto City Univ. of Arts, Kyoto 610-1197, Japan), and Toshio Irino (Wakayama Univ., Wakayama 640-8510 Japan)

We can identify vowels pronounced by speakers with any size vocal tract. Together, we can discriminate the different sizes of vocal tracts. To simulate these abilities, a computational model has been proposed in which size information is extracted and separated from the shape information. It is important to investigate temporal characteristics of the size extraction process. Experiments were performed for listeners to detect the size modulation in vowel sequences. All the sequences had six segments. Each segment contained one of three Japanese vowels: "a," "i," and "u." Size modulation was applied by dilating or compressing the frequency axis of continuous, STRAIGHT spectra. Modulation was achieved by changing the dilation/compression factor in sinusoidal functions. The original F0 pattern of the base sequence, except for warping of the time axis, was used for all stimuli. The minimum modulation depth at which listeners were able to detect the existence of modulation was measured as a function of the modulation frequency. The results will be compared with low-pass characteristics in a temporal modulation transfer function obtained with the amplitude-modulated noise. They will be discussed in relation to a computational model based on the Mellin transformation.

2pPP39. She hears seashells: Detection of small resonant cavities via ambient sound. Ethan J. Chamberlain, Lawrence D. Rosenblum, and Ryan L. Robart (Dept. of Psych., Univ. of California, Riverside, Riverside, CA 92521)

There is evidence that blind listeners can detect the presence of obstacles based on how the obstacles structure the ambient sound in a quiet room [Ashmead et al., J. Vis. Impair. Blindn. 9, 615 (1998)]. Potentially,

this ability is based on auditory sensitivity to the buildup of ambient wave interference patterns in front of the obstacle. This effect is not unlike how the internal structure of a seashell amplifies a room's ambient sound to emulate the sound of the ocean. Experiments were conducted to determine whether unpracticed, sighted listeners were sensitive to this information. Blindfolded listeners were placed in a quiet room and were asked to determine the location of a small resonant cavity placed next to either their left or right ear. Results revealed that listeners were very accurate at this task. Follow-up experiments examined the limits of this sensitivity as well as its acoustical support. These findings suggest that unpracticed listeners might be sensitive to subtle changes in the ambient acoustic structure of a quiet environment.

2pPP40. Effects of listening environment on speech recognition in noise. Linda Thibodeau and Tina Keene (Univ. of Texas at Dallas, 1966 Inwood Rd., Dallas, TX 75235)

The ability to recognize speech in noisy situations varies among individuals despite normal hearing. Although some of the variation may be related to physiological differences, some may be attributed to environmental experiences. The purpose of this investigation was to examine how everyday listening experiences were related to speech recognition in noise abilities. Using the Hearing in Noise Test, reception thresholds for speech were compared for listener groups who differed in their preferred listening levels for music and signal-to-noise ratios for daily communication. Results suggested that speech recognition in noise was related to listening levels. These results have implications for the use of assistive devices to improve the signal-to-noise ratio in adverse communication situations.

2pPP41. Comparing vowel formant thresholds from two tasks: Classification versus 2-alternative forced choice (2AFC) adaptive tracking. Eric Oglesbee (Dept. of Linguist., Indiana Univ., Bloomington, IN 47405, eoglesbe@indiana.edu) and Diane Kewley-Port (Indiana Univ., Bloomington, IN 47405)

Accurate classification of vowels in American English is difficult because of the number of acoustically similar vowels. Previous experiments in our lab [Kewley-Port et al., J. Acoust. Soc. Am. 118, 1929–1930 (2005)] described a new method to obtain formant thresholds using a classification task rather than the more typical 2AFC task. The goal of the present experiment was to directly compare formant thresholds estimated from a classification task with a modified 2AFC paradigm using adaptive tracking. Stimuli, generated by STRAIGHT, consisted of separate continua for formants F1 and F2 based on natural productions of "bid" shifted to "bed," and "cut" shifted to "cot." Separate 7- and 14-step continua were created for the classification and 2AFC tasks, respectively. Eight subjects participated first in the classification task, followed by the 2AFC task. Classification threshold results here replicated those observed in our previous experiments. Within-subject comparisons of the classification and 2AFC data refined our method for calculating a classification threshold from logistic psychometric functions. Individual thresholds calculated using this refined method were very similar to those from the 2AFC task. Results demonstrate the viability of using a more natural, single-interval classification task to estimate formant discrimination thresholds. [Work supported by Grant NIHDCD-02229.]

2pPP42. Cochlear and cognitive models for speech enhancement. Melissa Dominguez (DBK Acoust., 110 Village Station Ln., Grayslake, IL, 60030), Jeff Bondy, and Andrew Dittberner (GN Resound, Glenview, IL, 60026)

There has been a long running interest in using cochlear models for audio processing. Psychophysical masking stemming from normal cochlear operation is used as the basis for most audio compression circuits, while the cochleas mel-frequency response is mimicked by most automatic speech recognition circuits. An area that has been less well explored