outside the confines of "factory presets," and they take expert users out of their flow state. We present a new interface for programming synthesizers that enables both novices and experts to quickly find their target sound in the large, generative timber spaces of synthesizers. The interface does not utilize knobs and sliders that directly control synthesis parameters. It instead utilizes a query-by-example based approach combined with relevance feedback and active learning to create an interactive, personalized search that allows for exploration. We analyze the effectiveness of this new interface through a user study with four populations of varying types of experience in which we compare this approach to a traditional synthesizer interface. [Work supported by the National Science Foundation Graduate Research Fellowship.]

WEDNESDAY MORNING, 2 NOVEMBER 2011 GARDEN SALON 2, 7:40 A.M. TO 12:00 NOON

Session 3aNS

Noise and Committee on Standards: Impact of New Environmental Protection Agency (EPA) Regulation on Hearing Protection

William J. Murphy, Chair
National Inst. for Occupational Safety and Health, 4676 Columbia Pkwy., Cincinnati, OH 45226

Chair's Introduction—7:40

Invited Papers

7:45

3aNS1. Hearing protector labeling—Yes or no? Ken Feith (13404 Query Mill Rd., North Potomac, MD 20878, feithk@comcast.net)

The federal government has been accused of requiring needless product labeling in order to protect citizens from themselves. While there is probably some truth in these accusations, the key point of labeling is lost in the noise of criticism—at least in the case of hearing protector devices. If we were to consider the one word that most influences our life actions we would find it to be the word "decisions." A moment's thought would reveal that from the minute we wake in the morning until we achieve a deep state of sleep, we are confronted with the need to make decisions. Every move, every action, is determined by either conscious or subconscious decision making. To that end, we need to consider those elements that influence our decision making process—understandable and accurate information. Thus, the role of federal labeling of select products is to provide an understandable and accurate means for making decisions that may have an impact on our ability to function effectively in our work, maintain our good health, avoid personal injury, and the list goes on. This presentation reveals the secrets behind regulatory labeling.

8:15

3aNS2. Evaluation of hearing protection devices with high-amplitude impulse noise. Karl Buck, Sebastien DeMezzo, and Pascal Hamery (ISL, APC, 5 r. du Gn. Cassagnou, BP 70034, 68301 St. Louis, France, karl.buck@isl.eu)

Presently, the evaluation of HPDs (hearing protection devices) is mainly based on audiometric threshold methods. However, in the military environment soldiers may be exposed to impulse noise levels of 190 dB and higher if large caliber weapons or IEDs (improvised explosive devices) are considered. In this case it seems reasonable to expect that an evaluation done at hearing threshold might not represent the protection which will be encountered at these highest levels. Therefore, it is necessary to evaluate the HPDs with signals close to the effective exposure. ISL has developed procedures using explosive charges creating very high levels of impulse noise (up to 195 dB peak) for the evaluation of HPDs. ISL also has developed an artificial head that can withstand this type of exposure and has sufficient self-insertion loss for the measurement of double hearing protection. The presentation will give a description of the techniques used at the ISL. It will present some results showing the possibilities to determine the performance of different types of HPDs when subjected to extreme impulse noise levels. Moreover, the new version of the ISL artificial head, compatible ANSI-ASA-S12.42-2010, and possible problems when using it will be presented.

8:45

3aNS3. Comparison of three acoustics test fixtures for impulse peak insertion loss. William J. Murphy (Hearing Loss Prevention Team, NIOSH, 4676 Columbia Parkway MS C-27, Cincinnati, OH 45226, wjm4@cdc.gov), Gregory A. Flamme (Western Michigan Univ., Kalamazoo, MI 49008-5243), Deanna K. Meinke, Donald S. Finan (Univ. of Northern Colorado, Greeley, CO 80639), James Lankford (Northern Illinois Univ., DeKalb, IL 60115), Amir Khan (NIOSH, Cincinnati, OH 45226-1998), Jacob Sondergaard (G.R.A.S. Sound and Vib., North Olmsted, OH 44070), and Michael Stewart (Central Michigan Univ., Mount Pleasant, MI 48859)

Acoustic test fixtures (ATF) for testing the impulse peak insertion loss (IPIL) of a hearing protector are described by American National Standard ANSI S12.42-2010. The self-insertion loss, ear simulator design (canals, microphone, and temperature), hardness of the area surrounding the pinna, and the anthropometric shape of the head has been specified in the standard. The IPILs of four protector conditions were evaluated with three ATFs during an outdoor field study using firearm noise. The Etymotic Research ER20 musicians' earplug and electronic (EB1 earplugs), the Peltor Tactical Pro earmuffs, and a combination of the TacticalPro and ER20 protectors were

tested at 130, 150, and 170 dB peak sound pressure level with the Institute de Saint Louis heated and unheated fixture and the GRAS 45CB heated ATF. IPILs exhibited good agreement across all three fixtures for earplugs. Significant differences were observed between the fixtures for the earmuff-only condition. These differences were more evident for the double-protection condition. [Portions of this work were supported by the U.S. EPA Interagency Agreement DW75921973-01-0.]

9:15

3aNS4. Insertion-loss and transfer-function performance of two new acoustical test fixtures complying with ANSI S12.42-2010, relative to performance of prior test fixtures and to real-ear data. Elliott H. Berger, Ronald W. Kieper, and Michael E. Stergar (3M Occupational Health & Environ. Safety Div., 7911 Zionsville Rd., Indianapolis, IN 46268-1657)

The most recent American National Standards Institute (ANSI) standard for the measurement of the insertion loss of hearing protection devices (HPDs), ANSI/American Standards Association (ASA) S12.42-2010, specifies a new-concept acoustical test fixture (ATF). It is similar to some existing ATFs but differs in terms of the required earcanal length, inclusion of a simulated flesh lining the earcanal, and a heater to bring the test fixture to approximate body temperature. These features were deemed necessary to develop a device that provides insertion loss data with reasonable correspondence to performance on human heads, as the ATF is the preferred method in the standard for tests on certain electronic earplugs and for all impulse testing. Within a year of the issuance of the standard, at least two ATFs [one produced by G.R.A.S. Sound and Vibration and the other produced by the Institute of St. Louis] became available. The studies reported herein will provide an initial evaluation of these two heads compared to prior art, based on ATF insertion-loss measurements for a sample of passive earplugs and earmuffs versus real-ear attenuation at threshold per ANSI S3.19-1974. Additionally, the ATFs' transfer function of the open ear in a diffuse field will also be reported.

9:45

3aNS5. Attenuation performance of active noise reduction headsets using American National Standard s12.42 and the proposed U.S. Environmental Protection Agency Hearing Protector Labeling Regulation. Richard L. McKinley, Hillary L. Gallagher (Air Force Res. Lab., 2610 Seventh St. WPAFB, OH 45433, richard.mckinley@wpafb.usaf.mil), Melissa A. Theis (Oak Ridge Inst. for Sci. and Education, TN 37831), and Paul C. Schley (Ball Aerosp. and Technologies Corp., Fairborn, OH 45324)

The attenuation performance and noise reduction rating (NRR) of six commercially available active noise reduction (ANR) headsets was assessed using the proposed environmental protection agency (EPA) regulation. The passive attenuation results were collected using American National Standard Institute (ANSI) S12.6 method for measuring real-ear attenuation at threshold (REAT) of hearing protectors while the active attenuations results were collected using ANSI S12.42 methods for the measurement of insertion loss of hearing protection devices in continuous or impulsive noise using microphone-in-real-ear (MIRE) or acoustic test fixture procedures. ANSI/ASA S12.68 methods of estimating effective A-weighted sound pressure levels when hearing protectors are worn was used to compute noise reduction metrics including the noise reduction statistic A-weighted (NRSA) and the graphical noise reduction statistic (NRSG). The proposed NRR labels for the ANR headsets were computer per the guidance in the draft U.S. EPA regulation. The presentation will include the baseline passive, active, and total attenuation, the NRSA and the Graphical NRSG, and the proposed EPA labels for passive attenuation and total attenuation while in an active mode.

10:15–10:30 Break

Contributed Papers

10:30

3aNS6. 1.Comparison of the HPDLAB and REATMASTER software/hardware systems for ANSI S12.6 testing. David C. Byrne (NIOSH–Taft Labs., 4676 Columbia Parkway, MS C-27, Cincinnati, OH 45226, DByrne@cdc.gov), Caryn C. Perry (Univ. of Cincinnati, Cincinnati, OH 45267), and William J. Murphy (NIOSH–Taft Labs., Cincinnati, OH 45226)

The American National Standard Methods for Measuring the Real-Ear Attenuation of Hearing Protectors (ANSI S12.6-2008) requires a Békésy procedure for testing occluded and unoccluded thresholds. Since 2002, the National Institute for Occupational Safety and Health (NIOSH) has used the custom-designed HPDLAB software operating Tucker-Davis Technologies System 3 hardware. ViAcoustics, Nelson Acoustics, NASA, and NIOSH researchers recently developed REATMASTER which runs on National Instruments hardware in the LABVIEW environment. Ten subjects were trained by the experimenter on how to fit a passive earmuff and were qualified according to the requirements of ANSI S12.6-2008. The laboratory was configured such that diffuse sound field thresholds were tested with either the HPDLAB or REATMASTER hardware by flipping a toggle switch. The earmuff was not touched or re-positioned between test trials with the two different hardware/software systems. The test sequence for the order of open and occluded measurements was counterbalanced across occluded conditions and hardware system. Results from this testing were used to validate the REATMASTER system for its ability to produce accurate threshold data. Preliminary results indicate no significant differences between the two systems.

10:45

3aNS7. Calibration details for the impulse peak insertion loss measurement. William J. Murphy and Julia A. Vernon (Hearing Loss Prevention Team, NIOSH, 4676 Columbia Parkway MS C-27, Cincinnati, OH 45226-1998, wjm4@cdc.gov)

The American National Standard ANSI S12.42-2010 specifies the measurement of hearing protector performance in the presence of impulse noise. A series of calibration impulses are recorded from an acoustic test fixture (ATF) and a field microphone for peak sound pressure levels of 130, 150, and 170 dB. The averaged acoustic transfer function between the ATF and field microphone is calculated as follows:

$$\overline{H}_{\overline{ATF}-\overline{FF}}(f) = \overline{\langle FFT(P_{\mathrm{ATF},i}(t))/FFT(P_{FF,i}(t))\rangle}.$$

The transfer function is computed for each of the ranges of impulse levels and is applied to the field microphone measurements to estimate the unoccluded fixture levels of the ATF when hearing protection is being tested. This method allows a comparison between occluded and unoccluded waveforms. The calibration transfer function is affected by the time-alignment of the field impulse peaks, time-windowing of the impulses, and compensation for any dc bias. Time-alignment significantly affected the accuracy of predicting individual calibration levels with $\overline{H}_{\overline{\mathrm{ATF}}-\overline{\mathrm{FF}}}$. The prediction error variance was less at 170 dB than at 130 dB impulses. The time-window was varied from 2.5 to 100 ms preceding the peak of the field impulse. [Portions