University of Rochester
Department of Electrical and Computer Engineering
Audio and Music Engineering

The Physics of Auditory Proximity, Its Effects on Intelligibility and Recall, and Methods to Test for It, Particularly Binaural Recording Individually Equalized to a Listener

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Wednesday, November 2nd
12:00PM – 1:00PM
Computer Studies Building (CSB) 209

Abstract: This seminar will detail and demonstrate the many ways ears and speech have evolved to utilize the phase relationships of vocal harmonics to separate sonic information from complex and noisy environments. Early reflections randomize these phases, and in most rooms at some distance the ability to utilize these phases is lost. Speech becomes difficult to localize, intelligibility decreases, and information is difficult to recall. We call this the Limit of Localization Distance, or LLD. We believe the number of seats within the LLD is one of the most important determinants of acoustic quality. The seminar participants will be able to hear for themselves how the LLD can be determined by simply walking around with eyes closed during a lecture, a rehearsal or a performance. We will demonstrate this using a loudspeaker simulation of two violins playing together.

But it is not sufficient to simply determine where the good seats are. We need to know why they are perceived as good, and how acoustical conditions can be improved for seats that do not make the cut. We find that binaural recordings can provide this information if the headphones used to reproduce them can be accurately matched to the listener's eardrums. We have developed a Windows application that can provide this matching with a simple equal loudness test. A listener sits in front of a frequency-flat loudspeaker and determines his or her equal loudness curve using 1/3 octave noise bands. They then put on headphones and repeat the process to find the equal loudness curve of the headphones. The difference between these two loudness curves is the needed headphone equalization. Using this method we will demonstrate from a very limited binaural data set that the first lateral reflections in Boston Symphony Hall are either inaudible or detrimental. Deleting them from the impulse response of a poor seat improves the sound dramatically.

Bio: After completing his PhD in physics in 1978 on the Mössbauer effect in Zinc 67, David Griesinger independently developed one of the first digital reverberation devices, later to become the Lexicon 224. A more than thirty year stint as chief scientist for Lexicon followed, leading to many products, such as the LARES reverberation enhancement system and the Logic7 surround system. He has worked as a classical music recording engineer all his life, an avocation that may encourage a certain skill in listening to sound. His current work is on the mechanisms the ear and brain use to perceive sound, and how these mechanisms are affected by the acoustics in halls, operas, and classrooms of all types. Using this knowledge he has successfully improved several halls. He is the recipient of the gold medal of the German Tonmeister Society, a fellow and silver medal recipient of the Audio Engineering Society, and a papers reviewer for the AES, ASA, and Acta Acustica. He has also been active as a singer in various music groups, including the Boston Camerata, and a music reviewer for www.classical-scene.com, taking a special interest in the acoustical quality of venues. He lives in Cambridge Massachusetts, where enjoys his family, concerts, playing French horn, and making HD video recordings of musical performances.

Pizza and soda provided