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From the Editor: Special Issue on Auditory Scene Analysis

The most common complaint of a person with hearing loss is difficulty in understanding speech in noisy environments. Although communicating in noisy environments can prove challenging to people with normal hearing, the brain uses acoustic cues from a complex sound mixture to separate the speech signal of interest from competing sounds, a process known as *auditory scene analysis*. In a cocktail party, we can thus identify and concentrate on the speech of the person with whom we are speaking from the competing speech of other talkers, or follow a conversation among multiple talkers when seated at a table in a noisy restaurant. Although it has long been known that people with hearing loss have greater difficulty decoding speech in noisy situations (with or without hearing aids), little was known about how hearing loss or how the signal processing in hearing prostheses (hearing aids or cochlear implants) might affect specific aspects of listening thought to be important to auditory scene analysis.

This issue of *Trends in Amplification* contains a series of articles that focus on aspects of listening in complex environments by persons with hearing loss, the effect of hearing aids and cochlear implants on listener performance in difficult listening environments, and how information about the mechanisms underlying auditory scene analysis might be used to improve the design of hearing aids and cochlear implants.

In the first article, Shinn-Cunningham and Best focus on the role of selective attention in complex listening situations, that is, the "cocktail party" problem. They provide a description and explanation of why and how listeners with normal hearing are able to use attention to separate the wanted signal from a mixture of multiple voices, and they explain how the degradation of "bottom-up" cues because of hearing loss might affect auditory object formation and the ability to use selective attention. Finally, the authors address how hearing aids might help or hinder listening in complex listening environments.

In the second article, Marrone, Mason, and Kidd report the results of a study investigating the ability of hearing aid users to benefit from spatial separation of the target talker and competing talkers (spatial release from masking) in reverberant environments. Listeners with hearing loss were tested with and without their personal hearing aids (unilateral and bilateral test conditions). Age-matched listeners with normal hearing served as a control group. The study revealed that listeners with hearing loss did obtain benefit from spatial separation of the target and maskers, but the spatial release from masking was less than that obtained by listeners with normal hearing. Greater benefit was obtained in the bilateral listening condition.

The third article, by Oxenham, focuses on the role of pitch in grouping sounds from the same source and segregating sounds from different sources when listening in complex environments. The article provides a tutorial on current models of pitch perception, as well as a review of research on pitch perception and pitch and sound source segregation by listeners with normal hearing and hearing loss. The importance of preserving spectral information and temporal fine structure in hearing aid and cochlear implant processors is emphasized.

In the final article, Wang describes an engineering approach to the problem of separating signal from noise. Wang introduces the idea of using time–frequency masks for the purpose of separating speech from interfering noise and also reviews recent research in this area. The suitability of this approach for hearing aid applications is discussed.

Arlene C. Neuman, PhD
Editor-in-Chief

About the Authors

Barbara Shinn-Cunningham received her training in electrical engineering at Brown University (ScB, 1986) and the Massachusetts Institute of Technology (MS, 1989; PhD, 1994). She joined the faculty of Boston University in 1996, where she is an associate professor of cognitive and neural systems, biomedical engineering, and the program in neuroscience, and she is the director of graduate studies in the Department of Cognitive and Neural Systems. She also is an instructor in the Harvard/MIT Health Science and Technology Program and is on the board of directors for the NSF-funded Science of Learning Center CELEST. Her research includes studies of auditory attention, sound source separation, spatial hearing, cross-modal integration, neural coding, and perceptual plasticity. She is the recipient of fellowships from the Alfred P. Sloan Foundation, the Whitaker Foundation, and the National Security Science and Engineering Faculty Fellows program.

Virginia Best completed her PhD at the University of Sydney, Australia, in 2004. She then did postdoctoral work on spatial attention at Boston University's Hearing Research Center from 2004 to 2007. She is now a research fellow at the University of Sydney. Her current work is focused on the consequences of hearing loss for complex listening tasks involving attention and memory.

Nicole Marrone is an audiologist who earned her PhD from Boston University. She is now a postdoctoral fellow in the Department of Communication Sciences and Disorders at Northwestern University. Dr. Marrone has published articles on speech perception and informational masking in listeners with hearing loss. She is currently researching auditory perceptual learning in older adults and listeners with hearing loss.

Christine Mason is a research associate in the Psychoacoustics Laboratory at Boston University. She holds a bachelor's degree in psychology from Boston College and a master's degree in audiology from Purdue University. Her research interests include complex sound perception, informational masking, and the effects of hearing loss on speech recognition in multisource environments.

Gerald Kidd Jr. is a professor of audiology and hearing science in the Department of Speech, Language and Hearing Sciences at Boston University. He holds a bachelor's degree in speech and hearing and a master's degree in audiology from the University of Oklahoma and a doctoral degree in hearing science from Purdue University. His research involves studying central factors in auditory masking and the role of selective attention in multitalker sound fields.

Andrew J. Oxenham earned his PhD in experimental psychology from the University of Cambridge and is an associate professor in the Psychology Department at the University of Minnesota, where he directs the Auditory Perception and Cognition Lab. His research interests include auditory and speech perception in normal, impaired, and electric hearing. He has published more than 60 scientific journal articles and 10 book chapters in areas ranging from the perceptual correlates of cochlear amplification and compression, through pitch perception, to neural correlates of auditory awareness.

DeLiang Wang received his BS degree in 1983 and MS degree in 1986 from Peking (Beijing) University, Beijing, China, and his PhD degree in 1991 from the University of Southern California, Los Angeles, all in computer science. He is a professor in the Department of Computer Science & Engineering and the Center for Cognitive Science at the Ohio State University, Columbus. He has been a visiting scholar in the Department of Psychology at Harvard University, Cambridge, MA, and recently at Oticon A/S, Denmark. He served as the president of the International Neural Network Society in 2006. He received the U.S. National Science Foundation Research Initiation Award in 1992, the U.S. Office of Naval Research Young Investigator Award in 1996, and the Helmholtz Award from the International Neural Network Society in 2008. He also received the 2005 *IEEE Transactions on Neural Networks* Outstanding Paper Award from the IEEE Computational Intelligence Society. He is an IEEE Fellow. Dr. Wang's research interests include machine perception and neurodynamics. He has published extensively in these areas.