Auditory Perception

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The aim of this work is to further our basic understanding of normal and pathological hearing using behavioral, or psychophysical, techniques. The first theme involves assessing the influence of known peripheral physiological mechanisms, such as the nonlinear mechanics of the basilar membrane, on various aspects of hearing by comparing new psychophysical data with model predictions. Much of this work focuses on temporal processing, or how we are able to resolve sounds that occur in rapid succession. The working model of this process, known as the 'temporal window model', assumes that, after filtering and nonlinear transformations in the auditory periphery, more central processing can be modeled by a linear sliding temporal integrator, which smoothes the stimulus representation, thus attenuating rapid fluctuations. Tasks thought to test the limits of temporal resolution, such as gap detection and forward masking, have been used to provide data for the model. The surprising conclusion that processing beyond the auditory periphery can be treated as linear has been supported by our studies to date. Furthermore, initial results indicate that many deficits in temporal processing exhibited by people with sensorineural hearing loss can be quantitatively accounted for by the expected changes in peripheral processing (e.g., the loss of the 'cochlear amplifier'), without recourse to more central changes.

The second theme involves aspects of auditory object formation, or how we can so reliably break down an incoming sound waveform into its constituent components and identify the sources. Our previous work studied the role of periodicity, independent of spectrum, on our ability to segregate two patterns.[1] More recently this has been extended to investigate the role of interaural level and time differences.[2] The results from this study have shown that binaural differences between two stimuli do not necessarily lead to automatic segregation. While the results are inconsistent with previous claims, they may be intuitively understood in the sense that spatial cues, particularly interaural time differences, can be unreliable and ambiguous in a complex reverberant environment.

Publications

Journal Articles

B. C. J. Moore, D. A. Vickers, C. J. Plack, and A. J. Oxenham. "Interrelationship Between Different Psychoacoustic Measures Assumed to be Related to the Cochlear Active Mechanism," *J. Acoust. Soc. Am.* 106(5): 2761-2778 (1999).

A. J. Oxenham, and S. Buus. "Level Discrimination of Sinusoids as a Function of Duration and Level for Fixed-level, Roving-level, and Across-frequency Conditions," *J. Acoust. Soc. Am.* Forthcoming.

A. J. Oxenham. “Influence of Spatial and Temporal Coding on Auditory Gap Detection,” *J. Acoust. Soc. Am.* Forthcoming.

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References

[1]J. Vliegen and A. J. Oxenham, “Sequential Stream Segregation in the Absence of Spectral Cues,” *J. Acoust. Soc. Am.* 105(1): 339-346 (1999).
[2]A. J. Oxenham, “Influence of Spatial and Temporal Coding on Auditory Gap Detection,” *J. Acoust. Soc. Am.* Forthcoming.