Hearing Industry Research Consortium (IRC):
Lay Person Description of Project

Name (Primary Investigators):
Theo Goverts (VU University Medical Center, Amsterdam)
Steve Colburn (Hearing Research Center, Boston University)

Study Investigators and Affiliations:
Alieke Breure, Krista Jansen, Hans van Beek (VUmc, Amsterdam)
Andrew Brughera, Lorraine Delhorne, Jing Mi, Todd Jennings, Matti Groll (Boston University)

Project Title: A detailed look at speech recognition in realistic dynamic listening scenarios

Primary Project Goal: The overall goal of this project is to develop methods for evaluating listeners' abilities to understand speech from individuals in complex acoustic environments that occur in everyday life. These environments would include rooms with multiple sound sources, like restaurants or social situations with multiple people talking at the same time, as well as noisy environments like buses or train stations.

Knowledge Translation: The evaluation strategies developed in this project should lead to clinical evaluation procedures that can measure listeners' abilities in challenging listening environments in addition to the basic hearing thresholds and speech comprehension that are currently tested in standard evaluations. This would allow evaluations for hearing aids and hearing-aid fittings in more realistic situations, relevant for their participation, including situations that are often very challenging for hearing-aid users.

Results: Acoustic recordings from a variety of complex acoustical environments were made using techniques that preserve the signals to the two ears, including the differences that can be used to separate sources within the perceptual processing of the sounds. These recorded stimuli generally include sounds from multiple sources and they can be combined with single speech sounds to generate test stimuli for perceptual experiments. The recordings were analyzed to characterize the nature of the stimuli from these environments, including the inter-ear differences and the speech-likeness of the modulation patterns.

The acoustical characteristics of realistic and relevant listening situations differ from settings classically used for speech recognition testing in audiology; for example, the binaural parameter distribution is much broader. It was found that the speech-likeness of the realistic waveforms showed substantial variability between situations. Also, the speech-likeness varied between the left and right side, within situations. This latter underlines the importance of bilateral amplification with hearing devices.

Behavioral measurements were made to demonstrate the usefulness of the recorded waveforms. Listeners with normal hearing make use of bottom-up signal cues differently in different environments.

Finally, head movements during multi-source speech experiments were measured and characterized using a system developed for this purpose. The patterns of natural head

movement patterns vary over listeners and over listening conditions.

Overall, the materials and the techniques developed in this study provide insights about the mechanisms of speech recognition in everyday life. Moreover, they will be used for the development of clinical tests to characterize performance in complex environments with and without hearing devices.

Methods: Methods were developed for recording stimuli, generating related artificial stimuli, and conducting experiments to explore the importance of the precision of several stimuli parameters such as frequency, level, phase, and timing. We also developed methods for measuring head movements during listening experiments.

Background information about your research group:

The VUmc is group is based at a clinical facility with a record of basic and clinically applied research combining approaches from psychophysics and cognitive hearing science; major research themes include speech recognition, listening effort, quality of hearing care,The Boston University group is part of the BU Hearing Research Center and has been focused on basic hearing research that spans neurophysiological measurements and modeling, behavioral measurements and modeling, and the relationships between these areas.

References: Details and references are available upon request.

Contact information (optional): st.goverts@uvmc.nl, colburn@bu.edu