

A Very Special Issue

In our understandable efforts to reduce audition to its fundamental building blocks, we audiologists sometimes miss the forest for the trees. We tend to forget that cognitive processes like attention, memory, storage, and motivation are woven into the fabric of listening behavior. In this special issue of *JAAA*, guest editor Kathy Pichora-Fuller, of the University of Toronto, has assembled a distinguished panel of cognitive psychologists and asked them to relate concepts in cognition to audiological evaluation and rehabilitation. The resulting papers challenge us to view audiological activities in a much broader perspective, and to modify our actions accordingly.

James Jerger
Editor-in-Chief

Editorial

Rehabilitative Audiology: Using the Brain to Reconnect Listeners with Impaired Ears to Their Acoustic Ecologies



The importance of central auditory and cognitive processes to communication was recognized even in the earliest days of audiology (e.g., Davis, 1964), but only recently have the opportunities afforded by new diagnostic and rehabilitative technologies resulted in a renewed recognition of the need to apply advances in such knowledge to innovations in the practice of audiology (Pichora-Fuller and Singh, 2006). The inter-disciplinary synergies between psychology and audiology anticipated in the earliest days of audiology seem to come alive in the commentary of Fergus Craik, an internationally renowned cognitive aging researcher from Toronto, who reflects on how the knowledge accumulated in cognitive and neuroscience research over the last

half century could inform and be informed by the research on audiology and cognition that appears in this special issue.

Ever since I left the audiology clinic at Mount Sinai Hospital in Toronto about 20 years ago to study cognitive psychology, I have continued to hear the voices of people who are hard of hearing telling me that their communication function in everyday life is limited even though they wear hearing aids and even though they have attended rehabilitation training programs. My hope has been that new knowledge from research in cognition and neuroscience would inspire and guide new practices in rehabilitative audiology. I believe that the time to translate this laboratory knowledge into audiological practice has arrived and this view

M. Kathleen Pichora-Fuller, Ph.D., Aud (C), Professor, Department of Psychology, University of Toronto, 3359 Mississauga Rd. N., Mississauga, Ontario, Canada L5L 1C6; Phone: 905-828-3865; Fax: 905-569-4326; E-mail: k.pichora.fuller@utoronto.ca

is also reflected in the European HearCom audiological research initiative described in the contribution to this special issue by Tammo Houtgast and Sophia Kramer from the Netherlands. New insights into the connection between auditory and cognitive processing suggest how brain plasticity enables a hearing aid user to learn new mappings between sound inputs and stored knowledge. Importantly, individual differences in processing abilities seem to provide a key to understanding why two people with similar audiograms do not derive the same benefit from a particular hearing aid fitting, and how rehabilitative training may offset some of these differences. Understanding the role of cognition in listening has become an imperative for rehabilitative audiology (Kiessling et al., 2003). New rehabilitative practices based on understanding how the brain can reconnect listeners with impaired ears to their acoustic ecologies promise to improve the lives of people who are hard of hearing by facilitating their acclimatization to hearing aids and by enabling their fuller participation in everyday life. Nevertheless, many questions remain concerning the way in which practicing audiologists could or should measure an individual's cognitive abilities and how such measures might be used in rehabilitation assessment and management (Pichora-Fuller et al, 2006). The purpose of this special issue is to engage audiologists in thinking about how these exciting new research developments might advance the practice of audiology.

Recently, rehabilitative audiologists have recognized the importance of cognition for at least four reasons (see also Pichora-Fuller, 2006, 2007). Common to all four reasons is the rehabilitative significance of the link between audition and cognition and its likely importance for the design of future technologies and training programs. The six papers written for this special issue consider research findings related to these four reasons.

First, the ability of listeners, especially older listeners, to use knowledge stored in long-term memory and supportive context to compensate for declines in rapid processing of reduced sensory input underscores the relevance of interventions that harness cortical brain plasticity (for a review see Pichora-Fuller and Singh, 2006). The paper by Arthur Wingfield and Patricia Tun from Boston provides an excellent overview of how perceptual, attentional, and linguistic

operations support and constrain the comprehension of spoken language when listening is effortful. Listening can be effortful because the listener has a hearing loss and/or the listening situation is acoustically or informationally challenging. There are obvious applications of this research for the design of new rehabilitative training programs using realistic speech materials and a range of listening conditions.

Second, sensory and motor impairments, including hearing loss, may exacerbate or masquerade as cognitive declines. Bruce Schneider, Liang Li, and Meredyth Daneman from Toronto explore the interplay between audition and cognition in challenging listening conditions in research that attempts to differentiate between the effects of acoustical energetic and informational masking when speech is the competing signal. They suggest that it might be useful for audiologists to be able to evaluate a listener's ability to function with different types of maskers and distractors.

Third, the everyday challenges encountered by people living with hearing loss in the complex acoustic ecologies of the real world cannot be understood simply in terms of hearing impairment because everyday listening function is highly influenced by cognition. The paper by Claude Alain from Toronto and Kelly Tremblay from Seattle provides a valuable tutorial on how event-related potentials have given us new insights into the relative contributions of lower-level auditory and higher-level attentional processes to auditory scene analysis and how these findings might relate to how a listener functions in complex everyday acoustical environments.

Fourth, cognitive factors correlate with aided speech measures depending on the speed and complexity of the signal-processing and the nature of the speech and background signals used to test performance. Three papers explore the connection between cognition and listeners' performance with hearing aids. Larry Humes summarizes a program of research conducted at Indiana University that disentangles audibility from higher-level processes contributing to speech understanding. Thomas Lunner and Elisabet Sundewall-Thorén from Denmark describe a replication and extension of the landmark studies of Stuart Gatehouse, Graham Naylor, and Claus Elberling (2003, 2006). Their study reinforces the important connection between cognition and hearing aid outcomes in terms of speech in noise

performance, in particular when listeners use fast-acting signal-processing hearing aids and the background noise is modulated. As a complement to the study on cognition and hearing aid outcomes, Catherine Foo, Mary Rudner, Jerker Rönnerberg, and Thomas Lunner from Sweden describe a study examining the usefulness of different cognitive measures to predict success with hearing aids.

I am delighted to have had the opportunity to assemble this thought-provoking and forward-looking collection of papers. I believe that we have begun to find answers to some of the questions that motivated me to become a researcher as well as being an audiologist. It has also been an honor to work with the authors who have contributed to this special issue because they have become my friends and colleagues and I have learned so much from them and their work.

On a final note, this special issue is dedicated to the memory of Stuart Gatehouse, who died in February 2007. His scientific leadership and personal persuasiveness has played a powerful role in focusing the attention of rehabilitative audiologists on the importance of cognition to the practice of audiology. We will miss him greatly, but will continue to be inspired by his work as this topic goes on to stimulate future research and innovations in our practice.

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*M. Kathleen Pichora-Fuller, Guest Editor
University of Toronto and
Toronto Rehabilitation Institute*