BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. DO NOT EXCEED FIVE PAGES.

NAME: Todd Andrew Ricketts

eRA COMMONS USER NAME (credential, e.g., agency login): Ricketta

POSITION TITLE: Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Iowa, Iowa City, IA	B.A.	05/1989	Sp & Hearing Sciences
University of Iowa, Iowa City, IA	M.A.	05/1991	Sp & Hearing Sciences
University of Iowa, Iowa City, IA	Ph.D.	12/1995	Sp & Hearing Sciences

NOTE: The Biographical Sketch may not exceed five pages. Follow the formats and instructions below.

A. Personal Statement

The goal of improving the overall listening experience of individuals with hearing loss has been a central driving force in my work to date. I have completed several studies examining how hearing aid signal processing interacts with environments and individual listener's hearing abilities to affect performance and perception as well as ways signal processing can be enhanced and/or modified to limit important distortions.

B. Positions and Honors

Positions and Employment

1994-1995 Visiting Instructor, Department of Speech Pathology & Audiology, University of Iowa
1995-1996 Visiting Assistant Professor, Department of Speech Pathology & Audiology, University of Iowa
1996-1999 Assistant Professor, Department of Audiology & Speech Sciences, Purdue University
1999-2003 Assistant Professor, Department of Hearing & Speech Sciences, Vanderbilt University
1999- Co-Director, Vanderbilt Hands-on Hearing Aid Workshops
1999-2006 Guest Faculty, College of Extended Learning, Doctor of Audiology Program, Central Michigan University
2000-2004 Editor-in-Chief, *Trends in Amplification*
2003 Vice Chair, Vanderbilt University Institutional Review Board: Behavioral Science Committee
2003-2011 Chair, Vanderbilt University Institutional Review Board: Behavioral Science Committee
2004-2014 Associate Professor, Department of Hearing & Speech Sciences, Vanderbilt University
2011- Director of Graduate Studies, Department of Hearing & Speech Sciences, Vanderbilt University
2013- Associate Editor, Journal of Speech Language and Hearing Research
2014- Professor, Department of Hearing & Speech Sciences, Vanderbilt University

Honors

1997 The Purdue University chapter of the National Student Speech-Hearing Language Association Faculty Teaching Award: Outstanding Professor
1999 The Purdue University chapter of the National Student Speech-Hearing Language Association Faculty Teaching Award: Outstanding Professor
2001 Named "Outstanding Professor" by the Vanderbilt Audiology Graduating Class (2001).
2003 Mentor for Kiara Ebinger, "Does ECAP correlate with performance in CI recipients?", The American Academy of Audiology Student Research Forum Award winner.
2006 Named Fellow of the American Speech Language Hearing Association

2008	Editors Award from the American Journal of Audiology for "Ricketts TA, Galster, JA & Tharpe, AM (2007). Directional Benefit in Simulated Classroom Environments. American Journal of Audiology,16(2), 130-144.
2009	Mentor for Erin Picou, National Institute of Health Student Poster Award for "Speech recognition and subjective ratings with wireless speech transmission." Poster presented at the American Auditory Society, Scottsdale, AZ.
2010	Mentor for Erin Picou, National Institute of Health Student Poster Award for "Listening Effort, visual Cues and Individual Variability." Poster presented at Academy Research Conference, San Diego, CA.
2011	Mentor for Hannah Kim, Jerger Awards for Excellence in Student Research for, "Test-Retest Reliability of Open Hearing Aid Fittings in Children". Poster presented at the 2011 AudiologyNow! Conference, Chicago IL
2014	Elected to the Board of Directors, American Academy of Audiology

C. Contributions to Science

1) Identification of some of the benefits and limitations of microphone technologies to adult hearing aid users in realistic situations. Historical Background: Nearly two-thirds of older Americans have hearing loss and individuals with sensorineural hearing loss exhibit considerable difficulty understanding speech in noise, especially compared to peers with normal hearing. A significant challenge for hearing aid users is the fact that omnidirectional microphones do not improve the signal-to-noise ratio, and may even degrade it, due to microphone location. Microphone-based hearing aid technologies are the only methods that have been consistently shown to improve the speech recognition in noise for these patients. When I began work in this area, there was limited published data regarding the benefits and limitations of directional microphone technology for listeners in realistic listening environments, or how these benefits were affected by other hearing aid features or individual listener characteristics. Central Findings and Influence: My work in this area has significantly contributed to our understanding of how directional microphone interacts with patient and environmental factors, which has significant influence in hearing aid design and clinical practice. For example, my work demonstrating how microphone port angle and venting affect hearing aid directivity informed manufacturers about design improvements and informed clinicians about hearing aid coupling (e.g. Ricketts, T.A. (2000). Directivity quantification in hearing aids: Fitting and measurement effects. *Ear and Hearing, 21(1),* 45-58). In addition, my work demonstrating how gain equalization in directional hearing aids differentially affected speech recognition and audible microphone noise informed manufacturers and clinicians about optimizing low frequency gain when directional microphones are activated (e.g. Ricketts, T.A. & Henry, P. (2002). Gain equalization in directional hearing aids. *American Journal of Audiology, 11(1),* 29-41). Furthermore, my work demonstrating how patient position directly affects speech recognition performance with directional microphones informed clinical practice and patient counselling regarding optimizing hearing aid benefit (e.g. Henry P & Ricketts TA (2003). The effect of head angle on auditory and visual input for directional and omnidirectional hearing aids. *American Journal of Audiology, 12(1),* 41-51 and Ricketts, T.A. and Hornsby, B.W.Y. (2003). Distance and reverberation effects on directional benefit. *Ear and Hearing, 24(6),* 472-84). I served as PI on all of these projects.

2) Contributed to evidenced-based recommendations for use of directional microphone hearing aids in school aged children. Historical Background: Children with hearing loss can be deprived of important speech information in school environments due to listening in adverse situations typical of classrooms. This deprivation often results in difficulties with communication and academic achievement, as well as psychosocial and emotional problems. Directional microphone hearing aids are one of the only technologies with the potential to positively impact children's speech understanding in noisy classroom environments without requiring additional hardware. In addition, directional hearing aids are advocated for use in noisy school environments that contain multiple talkers of interest (e.g. lunchroom, group discussions). Central Findings and Influence: My work in this area has demonstrated how microphone settings (e.g. directional, omnidirectional, asymmetric) can lead to either improvements or decrements in speech recognition in noise (e.g., Ricketts, T.A., & Picou, E.M. (2013). Speech Recognition for Bilaterally Asymmetric and Symmetric Hearing Aid Microphone Modes in Simulated Classroom Environments. *Ear and Hearing, 34(5)*, 601-609). This significantly contributed to our understanding of

how microphone settings can interact with patient factors and specific school listening environments (e.g., Ricketts TA & Galster, JA (2008). Head Angle and Elevation in Classroom Environments: Implications for Amplification. *Journal of Speech, Language and Hearing Research, 51(2)*, 516-525). In addition, they highlight how some microphone technologies can be detrimental in situations where overhearing is required (e.g. Ricketts TA, Galster, JA & Tharpe, AM (2007). Directional Benefit in Simulated Classroom Environments. *American Journal of Audiology, 16(2)*, 130-144;). These findings inform clinical practice relative to expectations counselling, microphone settings, and the potential for directional benefit. Further, the finding that school environments can have poor signal-to-noise ratios informed manufacturers and led to hearing aid designs in which the aggressiveness of directional switching could be modified (e.g. Ricketts TA, Picou, EM, Galster, JA, Federman, MS & Sladen, DP (2011). Potential for Directional Hearing Aid Benefit in Classrooms: Field Data. In R.C. Seewald (ed.) *A Sound Foundation Through Early Amplification 2010: Proceedings of the Fifth International Conference,* Phonak, Chicago, pp. 143-152). I served as PI on all of these projects.

3) Contributed to the knowledge base regarding the potential spatial advantages provided by bilateral cochlear implants in comparison to their unilateral counterparts. Historical Background: Continued technological advances in cochlear implant technology have allowed many cochlear implant recipients to achieve open set word recognition in the presence of background noise. Despite these improvements, significant difficulties understanding speech in background noise and difficulty localizing sounds in the environment still exist for many implant recipients. One potential method for increasing performance in noise and localization accuracy through cochlear implants is bilateral implantation. In collaboration with colleagues, the potential benefits and limitations of bilateral cochlear implants and factors underlying limitations were explored. My contributions included all aspects of this work; however, I was the lead contributor regarding speech recognition evaluations and interactions with processing. Central Findings and Influence: Our work in this area demonstrated significant bilateral advantages related to speech recognition in complex environments and localization in the horizontal plane Further, we demonstrated that while experience generally improved performance, it had a negligible effect on the magnitude of bilateral benefits. (e.g. Ricketts TA, Grantham DW, Ashmead DH, Haynes DS & Labadie RF (2006). Speech Recognition for Unilateral and Bilateral Cochlear Implant Modes in the Presence of Uncorrelated Noise Sources. Ear and Hearing, 27(6), 763-773; Grantham DW, Ashmead DH, Ricketts TA, Labadie R & Haynes DS. (2007). Horizontal-plane localization of noise and speech signals by post-lingually deafened adults fitted with bilateral cochlear implants. Ear and Hearing, 28(4):524-41). We identified limited interaural time difference cues as a key factor limiting performance. In addition, we demonstrated how front end compression processing further distorted interaural level difference cues also degrading localization performance(e.g. Grantham DW, Ashmead DH, Ricketts TA, Labadie R & Haynes DS. (2008). Interaural time and level difference thresholds for acoustically presented signals in post-lingually deafened adults fitted with bilateral cochlear implants using CIS+ processing. Ear and Hearing, 29(1), 33-44). I served as PI or co-investigator on all of these projects.

4) Contributed to the knowledge base regarding factors that affect objective listening effort. Historical Background: While speech recognition abilities are typically viewed as paramount when considering receptive communication, there is increased interest in how extra-perceptual factors like listening effort, affect the total communication experience. Further, how factors such as hearing loss and specific hearing aid processing interventions impact listening effort are also of interest because the consequences of sustained increases in listening effort may be substantial, including mental fatigue, communicative disengagement, decreased physical well-being, and reduced academic/vocational involvement. Central Findings and Influence: Our work in this area has increased our understanding of how changes in the secondary task in a dual task paradigm can affect the sensitivity of objective measures of listening effort as a function of age (Picou, E.M. & Ricketts, T.A. (2014). The effect of changing the secondary task in a dual-task paradigm for measuring listening effort, *Ear and Hearing, 35(6),* 611–622). In addition, we have shown that hearing aids can improve listening effort (Picou, E.M., Ricketts, T.A., & Hornsby, B.W.Y. (2013). How hearing aids, background noise, and visual cues influence listening effort. *Ear and Hearing, 34(5), e52-64*), but that some hearing aid features improve speech recognition performance without affecting effort (e.g. Picou, E.M. Aspell, E. & Ricketts, T.A. (2014). Potential benefits and limitations of three types of directional processing in hearing aids. *Ear*

and Hearing, 35, 339 – 352). Furthermore, we were the first to demonstrate that listening effort can be affected by cognitive factors (motivation) and not only environmental factors, like noise (Picou, E.M., & Ricketts, T.A. (2014). Increasing motivation changes subjective ratings of listening effort and choice of coping strategy. *International Journal of Audiology, 53,* 418 – 426). I served as co-investigator on all of these projects.

5) Contributed to the knowledge base regarding the interaction between specific hearing aid technologies, individual patient factors and specific listening situations. Historical Background: For people with permanent hearing loss, especially the type that is acquired as a result of noise exposure or aging, there is no medical cure. Instead, the most common remediation is hearing aid provision. Therefore, it is important that we understand all of the benefits and limitations of hearing aids for listeners' total communication experience in order to optimize selection and adjustment of these technologies and enhance use counselling for patients. Central Findings and Influence: Our work in this area has increased our understanding of the types of environments for which bilateral beamforming is effective at improving speech understanding and the environments for which use of this technology should be avoided (Picou, E.M., Aspell, E. & Ricketts, T.A. (2014). Potential benefits and limitations of three types of directional processing in hearing aids. *Ear and Hearing, 35,* 339 - 352). We demonstrated that the limited effects of non-linear frequency compression in listeners with mild hearing loss does not preclude its use in this population (Picou, E.M., Marcrum, S.C. & Ricketts, T.A. (2015). Evaluation of the effects of nonlinear frequency compression on speech recognition and sound quality for adults with mild to moderate hearing loss. *International Journal of Audiology, 54,* 162 - 169). We demonstrated the relative impact of hearing loss and the wireless streaming configuration on benefits from these technologies (Picou, E.M. & Ricketts, T.A. (2011). Comparison of wireless and acoustic hearing aid-based telephone listening strategies. *Ear and Hearing, 32,* 209 – 220; Picou, E.M. (2013). Efficacy of hearing-aid based telephone strategies for listeners with moderate-to-severe hearing loss. *Journal of the American Academy of Audiology, 24,* 59 - 70). As a whole, these results have increased our understanding of the interactions between technology and binaural hearing, as well as guiding clinical practice. I served as co-PI or co-investigator on all of these projects.

Complete List of Published Work in MyBibliography:
http://www.ncbi.nlm.nih.gov/sites/myncbi/1BwZUEGdS72QA/bibliograpahy/48077434/public/?sort=date&direction=ascending

D. Research Support

Ongoing Research Support

Phonak AG (Picou/Ricketts) 08/01/2013-08/30/2016
The Impact of Hearing Aid Processing on Persons with Hearing Loss
The major goals of this research are to develop measures that have optimal sensitivity to some of the psychosocial consequences of hearing loss including listening effort and emotion, to determine what individual variables mitigate listening effort, and to identify processing which either degrades or enhances listening effort based on individual patient predictor variables.

Oticon AG (Ricketts/Picou) 12/01/2013-12/30/2015
Considering Individuals and Overhearing for Optimization of Microphone Technology Settings in Children with Impaired Hearing
The major goals of this research is to develop and refine individualized hearing aid microphone technologies and clinically efficient measures designed to select and optimize directional microphone technologies.

GN Resound (Ricketts/Picou) 06/01/2013-05/30/2016
Individual Head Related Transfer Functions and Sound Externalization (Phase 4)
The major goals of this research are to identify and enhance hearing aid processing so that it has little or no negative effect on spatialization abilities.

NSF STTR Phase I (1b) 1417090 (Ambrose/Ricketts) 7/01/2014-12/31/2015
The major goal of this research is to examine how a new earphone modification effects loudness, comfort and frequency response and use this data to optimize the design.

Select Completed Research Support

NIH SBIR Phase I: Inflatable Ear Seal (1 R43 DC012464-01) 02/01/2012-09/30/2012
The major goal of this research was to develop and refine a one size fits most coupling system for hearing aids.

GN Resound (Ricketts) 07/01/2013-06/30/2014
Evaluation of a Bilateral Beamformer
The major goals of this research are to develop and refine a commercial bilateral beamforming hearing aid.