FUELING DISCOVERY

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Better Ears For Better Lives

RUTH LITOVSKY

I stood next to the mother of the four-year old girl who had only recently received a cochlear implant in her second ear. As the girl walked away to play, the mom called her name and the girl immediately turned around to find her mother's voice. The mom was astounded. Her child, who was born with congenital deafness, had received her first cochlear implant early enough to access spoken language, but with only one implant she had struggled with understanding speech in noisy environments or locating sounds. To the mother, and to me, it was amazing seeing how her second implant had dramatically diminished these challenges.

We all spend much of our lives functioning in environments where our brains receive a barrage of sounds and echoes. Yet somehow, individuals with typical hearing can block out most echoes (except for ones with long time delays, as in canyons) and do a very good job locating the sources of sounds around us. Moreover, in a noisy restaurant we can focus on what one person is saying despite a cacophony of chatter and clatter in the background. These abilities are driven by an intricate set of connections in our brain known as the 'binaural system' which combines information from the two ears to help us live full, socially rich lives. Throughout my research career I have been passionate about understanding how our brain uses binaural information to compute sound locations and suppress echoes, and how we can use this science to guide clinical practices.

My lab at the Waisman Center has been instrumental in showing that, for those children and adults who choose to receive cochlear implants, bilateral implants provide significant advantages, especially in noisy environments. However, we have also found that bilateral cochlear implant users continue to face daily challenges because current cochlear implant technology strips out much of the information that the brain uses to build a three-dimensional picture of the auditory world. Armed with this knowledge, my lab has used reverse engineering approaches to develop new ways to coordinate information between the two implants. Our goal is to improve users' quality of life by helping them better localize sounds, understand speech in noisy settings, and expend less cognitive resources to learn, socialize and communicate in their daily lives.

LITOVSKY BINAURAL HEARING AND SPEECH LAB

Young child fitted with bilateral cochlear implants is seated in a sound proof testing room in the Litovsky Binaural Hearing and Speech Lab. The child is listening for words that are presented from the loudspeakers, and using a computer game to indicate what they are hearing and where the sounds are coming from.

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Research on binaural hearing in my lab has recently expanded into a unique population of individuals with Down syndrome (a common genetic cause of intellectual and developmental disability). There is a high incidence of hearing loss in this population, but there has been little prior work on binaural hearing and functioning in everyday environments and on whether these factors correlate with cognitive and language delays. We aim to identify ways in which treating hearing loss can improve everyday listening and enhance social integration.

Research on binaural hearing is also an important consideration in understanding the normal aging process. There is growing evidence to suggest that active and effortful listening is costly to some brain mechanisms. This explains why even low-grade hearing loss, if left untreated, can cause social isolation. Moreover, gradual declines in hearing may even be a direct contributor to age-related declines in cognition (memory, attention, executive function), also known as dementia. For this reason, I am excited to be launching a new line of research where I can use my knowledge of spatial hearing to develop better diagnoses of binaural decline, and guide clinical practices aimed at improving communication and quality of life in later years.

About the author

Ruth Litovsky is Oros Family Chair, and Department Chair of Communicative Sciences and Disorders in L&S. She has been on faculty for 21 years, directs a research lab at the Waisman Center, has won multiple career awards and served in many leadership positions in scientific organizations and at UW-Madison.