# From data-driven auditory profiling to scene-aware signal processing in hearing aids

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Despite advances in acoustic technology, modern hearing aids have yet to solve the fundamental problem of restoring hearing in everyday sound environments. Finding the best compensation strategy for an individual hearing-impaired person represents a major challenge since the consequences of a typical hearing loss are much more complex than just a reduced sensitivity to sound as reflected in the pure-tone audiogram. In fact, characterizing the "auditory profile", which would require many more measurements than are currently conducted in audiology clinics, seems essential for optimizing the amplification strategy in hearing-aid fitting for each individual. Furthermore, while normal-hearing listeners are able to focus attention on one particular sound source and ignore others, this ability is reduced in listeners with hearing impairment. The crucial problem of modern hearing aids is that they do not know which acoustical source an impaired listener would like to hear. To solve this problem, hearing aids need to evolve from sound processors to 'brain processors' collecting information from the listener to selectively amplify only the sounds that the listener is trying to focus on. Such a revolution requires significant breakthroughs in terms of our fundamental understanding of hearing. Specifically, we need models that bridge the fundamental gap between sound processing in the inner ear and processing in the brain. The ability of the auditory system to extract meaningful 'auditory objects', like speech or music, from a mixture of sound waves arriving at the ear involves multiple stages of processing. The goal of modern hearing research and technology is to develop functional models of hearing that integrate these levels of processing to investigate how the 'listening brain' actively modulates sound processing to serve behavioral goals.