

# Approaching Sound Localization by Top-Down and Bottom-Up Methods

The internal representation of a complex acoustic scene like cocktail party situation is based on various mechanisms, which are investigated on different levels in psychoacoustics and neurophysiology. In psychoacoustics, top-down approaches involve studies on attentional and cross-modal effects including plasticity of auditory spatial representations in more central parts of human brain. Bottom-up methods in psychoacoustics involve studies on sound localization and underlying effects in more peripheral parts of the brain. At this stage, the mechanisms behind the effects of electric stimulation used by prosthetic auditory devices like cochlear implants are different from those in acoustic hearing. This issue is addressed in the experimental design of bottom-up psychoacoustic studies, where especially the comparison between both stimulation types provides insight into the underlying mechanisms. The results from psychoacoustic studies are used in neurophysiology to model parts of the human brain. Again, two types of approaches are considered. Top-down approaches develop artificial models of neural processing with the aim of a good representation of the psychoacoustic data. In contrast, bottom-up approaches develop computational models at a single cell level and build simplified network models of the ascending auditory brainstem and midbrain based on reduced abstract neural models and phenomenological plasticity rules.

All these approaches are strongly intertwined and thus an inter-disciplinary exchange of knowledge is required to allow a proper interpretation of the results. Hence, a research network for studying sound localization including top-down and bottom-up approaches on the psychoacoustic and neurophysiologic levels has been created. This contribution presents the research fields of this network including its capabilities and constraints.