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Mechanisms and models of normal and impaired hearing

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There are at least two main reasons why auditory processing models are constructed: to represent the results from a variety of experiments within one framework, and to explain the functioning of the system. Specifically, processing models help generate hypotheses that can be explicitly stated and quantitatively tested for complex systems. The models can also help determine how a deficit in one or more components affects the overall operation of the system. The development of auditory models has been hampered by the complexity of the individual auditory processing stages and their interactions. The result is a multiplicity of auditory models described in the literature which differ in their degree of complexity and quantification. Most of the models can be broadly referred to as functional models, that is, they simulate some experimentally observed input-output behavior of the auditory system without explicitly modeling the precise internal physical mechanisms involved. In this talk, several models of normal and impaired auditory processing are summarized. The emphasis will be on physiologically inspired perception models and the perceptual consequences of hearing impairment with respect to frequency analysis, temporal (fine-structure and envelope) analysis, speech perception and pattern recognition. Some of the models can be useful for technical and clinical applications, such as improved man-machine communication by employing auditory-model-based processing techniques, or new processing strategies in digital hearing aids and cochlear implants.