Predictive adaptation to change in audition: principles, event-related-potentials, lesion-symptom mapping

Michael Schwartze[1]

[1]Dept. of Neuropsychology and Psychopharmacology, Maastricht University, Maastricht, Netherlands

The sense of hearing rests on the processing of events unfolding in time. These events convey patterns of variable complexity, from the clicks of a metronome to music, from morse-code to speech. Efficient use of regular inter-event-relations, e.g., probabilistic associations or temporal regularity, allows predicting the type and timing of future events. In turn, the ability to predict future events may spare cognitive resources and optimize adaptation to an ever-changing environment. This presentation introduces a holistic neurofunctional framework integrating these aspects. Functional components of this framework were tested in a series of neuroimaging studies in which participants listened to classic "oddball" sequences to explore the influence of various ordering principles (regularity, grouping, periodicity) on cognitive processes, i.e., attentive deviance processing and sensory gating as indexed by the P50 event-related potential of the electroencephalogram (ERP/EEG). Structural components of the framework were investigated by testing patients with focal basal ganglia lesions using the same experimental setup in combination with a formal voxel-based lesion symptom mapping approach. The results confirm independent representations and dissociable modulatory effects of the respective ordering principles on ERPs, suggesting that temporal ordering can be used to optimize normal function and to compensate for dysfunction in auditory cognition.