

Uni-modal and multi-modal cortical plasticity and how tailored music reverses maladaptive cortical reorganization

Prof. Dr. Christo Pantev,

Institute for Biomagnetism und Biosignalanalysis, University of Münster

During the last years music has increasingly been used as a tool for the investigation of human cognition and its underlying brain mechanisms. Music relates to many brain functions like perception, action, cognition, emotion, learning and memory and therefore music is an ideal tool to investigate how the human brain is working and how different brain functions interact. Novel findings have been obtained in the field of induced cortical plasticity by musical training. The positive effects, which music in its various forms has in the healthy human brain are not only important in the frame work of basic Neuroscience, but they also will strongly affect the practices in neurorehabilitation.

In my talk I am going to present the results of studies on the effect of musical training on auditory processing by means of magnetencephalography (MEG) and comparisons of musicians and non-musicians as well as induced brain plasticity effects trough laboratory training. We have found short- and long-term training effects behaviorally as well as electro-physiologically and our experimental results suggest that the multimodal nature of the training is crucial for the observed brain plasticity effects.

One last topic is tinnitus. Tinnitus is presumably caused by maladaptive auditory cortex reorganization. Since cortical organization can be modified by behavioral training, we attempted to reduce tinnitus loudness in chronic patients with tonal tinnitus by exposing them to self-chosen, enjoyable music, which was modified ('notched') to contain no energy in the frequency range surrounding the individual tinnitus frequency. After 12 months of regular listening, the target patient group showed significantly reduced subjective tinnitus loudness (>25 % improvement on average), and concomitantly exhibited reduced evoked activity in primary and secondary auditory cortical areas corresponding to the tinnitus frequency compared to patients who had received an analogous 'placebo' notched music treatment and patients listening to non-modified music. These findings substantiate that chronic tinnitus can be significantly diminished by reversing the underlying maladaptive neocortical reorganization.