



E. Altenmüller

Eckart Altenmüller

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| 1983 | Dr. med. University of Freiburg /Germany |
| 1985 | M.A. University for Music, Freiburg (Orchestra Diploma) |
| 1983–1985 | Postdoctoral work at the Department of Clinical Neurophysiology |
| 1985–1992 | Internship and Habilitation, Department of Neurology, University of Tübingen |
| 1992–1994 | Assistant Professor, Department of Neurology, University of Tübingen |
| 1994–present | Full Professor, Head of the Department of Music-Physiology and Musician's Medicine at the University of Music and Theater, Hannover. |

Current Research

We consider music perception and music production, the research focus of our institute, as excellent paradigms to study the neurosciences of complex systems such as auditory perception or motor execution in a much more general framework.

1. Affective Neuroscience of Music

Music is a powerful means to elicit and to produce emotions. The neurobiological basis of these strong emotional reactions are poorly understood. In previous work we demonstrated that emotional valence judgements during listening to complex auditory stimuli depend on a widespread bilateral fronto-temporal network with a highly significant lateralisation effect: positive emotional attributions are accompanied by an increase in left-temporal activation, negative by a more bilateral pattern with preponderance of the right fronto-temporal cortex.

Presently, we are investigating the neurobiological basis of strong emotional responses to music (SEM), leading to shivers down the spine and changes in heart rate. From previous studies it is known that these SEMs are accompanied by the activation of areas that are thought to be involved in reward, emotion and motivation. In order to delineate the acoustic 'gestalt' of music producing SEMs, pieces of music eliciting strong emotional reactions are analyzed according to psychoacoustic criteria. In parallel psychophysiological as well as neurophysiological responses are recorded in listeners. Methods include DC-EEG, psychophysiology, neuropsychological assessment and fMRI in collaboration with the Hannover Medical School.

2. Motor Learning and Movement Disorders

Music making is an excellent paradigm to study motor learning. Using three dimensional motion analysis at high temporal resolution, electromyography, and recording of brain activity, the objective of the analysis is to accurately describe mechanisms of motor learning, and to apply this knowledge to optimize learning strategies for instrumental teaching. Using multi-channel EEG-recording, event related potentials and slow waves with subsequent source analysis, the main focus of recent research was the demonstration of changes in brain activation patterns induced by piano-training. Presently we are conducting research into the neurobiological basis of musicians' focal dystonia, a disorder which is characterized by involuntary cramping of individual fingers whilst playing the instrument. Methods include DC-EEG, fMRI, and movement analysis.

Future Projects and Goals

A long term goal is to clarify the components and the dynamics of brain networks subservient music processing in general. One further important question is to delineate the degree to which emotional processing of music relies on universals shared by all humans.

Concerning movement disorders in musicians, we hope to identify the most important risk factors, in order to better prevent focal dystonia in musicians. Finally we believe that a better understanding of the underlying pathology may lead to improved therapeutic options.

Selected Publications

[1] Münte, TF, Kohlmetz C, Nager W, Altenmüller E. Superior auditory spatial tuning in professional conductors. **Nature** 409, 580 (2001)

[2] Altenmüller E, Schürmann K, Lim V, Parlitz D. Hits to the left – Flops to the right. Different emotions during music listening are reflected in cortical lateralisation patterns. **Neuropsychologia** 40:2242-2256 (2002)

[3] Münte TF, Altenmüller E, Jäncke L. The musician's brain as a model of neuroplasticity. **Nature Reviews Neuroscience** 3, 473-478 (2002)

[4] Bangert M, Altenmüller E. Mapping Perception to Action in Piano Practice: A longitudinal DC-EEG-study. **BMC Neuroscience** 4:26-36.(2003)

[5] Altenmüller E. Focal Dystonia: Advances in Brain Imaging and Understanding of Fine Motor Control in Musicians. **Hand Clinics** 19: 1-16 (2003)

Group Structure

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| Group leader: | Eckart Altenmüller |
| Postdoctoral fellow: | Hans Christian Jabusch |
| Graduate students: | Frederik Nagel, Oliver Grewe, Katja Goydke, Patricia Senghaas, Ken Rosslau |
| Engineer: | Dieter Drescher |

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