PERACT

Perception and Action in Space

- training
- research
- integration
- network
- science
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- excellence
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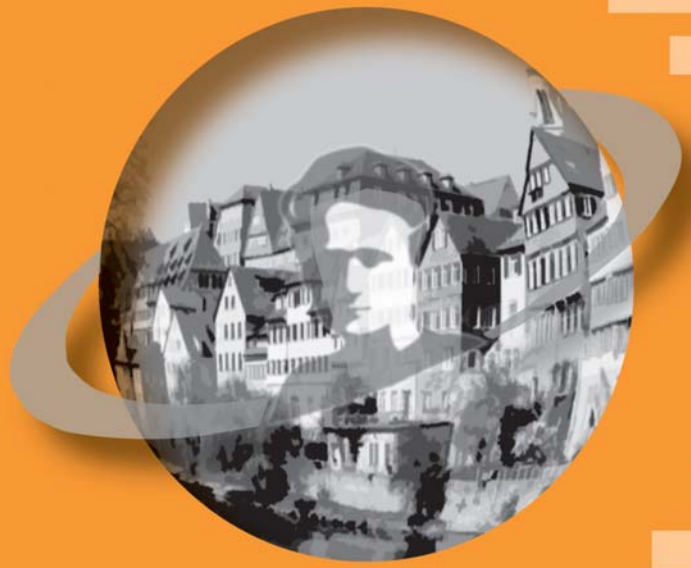

PERACT
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Perception and Action in Space

PERACT is concerned with developing our understanding of the brain mechanisms, which subserve our ability to plan and control action in space. Specifically, it focuses on the sensorimotor processes, which underlie the integration of sensory information and the translation of sensory signals into motor commands. This is not only an interesting and central issue within systems neuroscience but also is likely to yield much in terms of novel therapies to alleviate the consequences of brain damage or disease following head-injury. In addition, the interaction with machine learning and robot control will be fruitful for understanding neural mechanisms on the level of information processing. For studying and teaching this field of research, PERACT brings together scientists working with a wide range of techniques from theoretical modelling, single cell recordings in behaving monkeys, clinical neuropsychology, to system biology and functional imaging techniques such as functional magnetic resonance imaging (fMRI), and transcranial magnetic stimulation (TMS).

This Research Training Project focuses on the production of adaptive spatial behavior based on the interplay of perception, central information processing, memory, learning, and motor action. The processing stream from perception to action will be studied on various levels. By quantitative measurements of behavior of freely moving humans and animals, as well as by synthesizing navigation and grasping with biomorphic robots, we will address the overall performance. On a finer level, sensory contributions are investigated using psychophysical techniques, e.g. by varying the available sensory information, as well as by tracking movements of the eyes. Neural mechanisms are studied by quantifying the behavioral deficits resulting from brain damage in patients (occipital and parietal lobes) or from experimental cooling of parts of the parietal lobe in monkeys. Single cell electrophysiology and functional brain imaging will be used to investigate neural mechanisms in the normal brain. Finally, statistical learning theory will be employed to study learning of sensorimotor coordination and recovery after brain damage.

The interplay of perception and action is mediated by the flows of information from the environment to the organism, between sensors and effectors within the organism, and from the organism to the environment. It is this notion of information, i.e. an entity coupling perception and action, which is studied in biological information processing. Only in this framework is it possible to define the notion of relevance of a piece of information for the organism. This is especially clear in spatial behavior, which is always a closed loop of perception and action. The project focuses on two well-defined tasks in the field of spatial behavior, (i) path following and obstacle avoidance in cluttered environments and (ii) hand movements for pointing, grasping, and manipulation.

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