

SFB/TR 8 – A6 (Reactive Space)

Dr. Ing. Carsten Gremzow

Robotics Group

University of Bremen



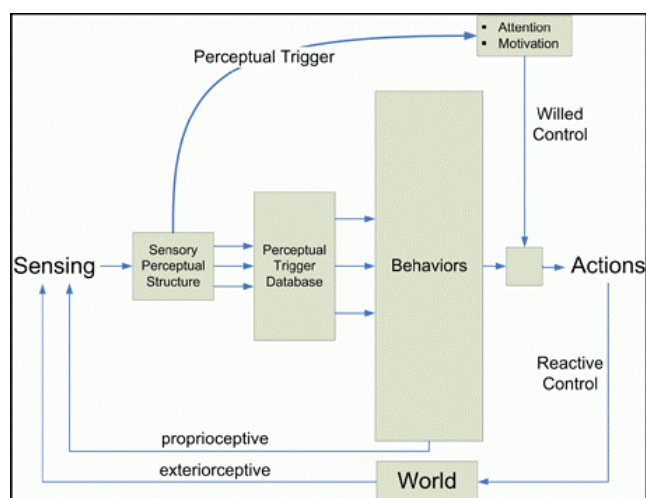
Universität Bremen

www.Informatik.uni-bremen.de/robotik

The project A6-[ReactiveSpace] is one of the "action" projects of the SFB/TR8 Spatial Cognition Center located in Bremen which is carried out in cooperation with the Albert-Ludwigs-Universität Freiburg. This project emphasizes on basic research in the fields of spatial learning, spatial representation and navigation control in the field of mobile, autonomous robots.

Recent approaches in cognitive psychology grant the body a much greater role in the process of understanding and acting in the environment. It is claimed that motor activities significantly contribute to the performance of cognitive tasks. So far, the cognitive robotics community has not extensively applied these results. One reason may be the sparse availability of kinematically competent robotic systems; another reason may be that it is still unclear exactly how motor activities are exploited to understand the environment. The research proposed here identifies two claims that seem to play an interesting role in spatial understanding for cognitive robots:

To experiment with "embodied cognition", we propose the use of a multifunctional four legged robot kinematically capable of walking and climbing on four legs as well as of grasping objects with two legs used as arms. The arms will therefore be equipped with grippers, which are capable of grasping and manipulating objects. The robot is further equipped with exteroceptive sensors like distance measurement sensors (e.g. ultrasound, infrared) and a camera system in its head segment. The robots sensory system will not focus on these exteroceptive sensors. The main emphasis will lie on the tactile sensors which are integrated in the gripping mechanism of the hands/feet, and proprioceptive sensor information gathered from the robots complex kinematic structure instead of relying exclusively on complex vision based information. The proprioceptive data will be gathered from the motor current drawn by each motor and the motor angles as well as the pressure sensors located in the hands/feet. This robot will serve as a test-bed for the implementation and evaluation of a hybrid architecture for spatial learning, representation, and navigation control.



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The role of manipulation acts in understanding spatial geometries goes back to the idea that cognitive systems offload as much of the computational burden as possible onto the environment to understand spatial structures. Instead of generating and transforming complex mathematical models of 3-D geometries, cognitive systems use motor acts to generate multi-modal perceptual inputs, which they use to test hypotheses about the nature of the geometric structure at hand. The interplay of complex motor acts (behaviors) and perceptual structures for robot exploration will be investigated for exploring large-scale spatial structures of unknown environments. Robot navigation today often tries to generate precise maps of the environment. However, the concept of precise spatial information appears to be overambitious in many, especially non-homogenous and unknown spatial domains. Instead, cognitive systems seem to represent space based on their internal ability to deal with it. In this project we will investigate possibilities of augmenting maps with motor activity information from a walking robot to provide additional information, e.g., about terrain structure.

The architecture that we will implement will be used for reactive exploration of unknown environments. In this case the system will be given a set of 'perceptual triggers'. These are percepts that are likely to occur during the exploration process. The perceptual trigger is a collection of mostly tactile and proprioceptive data that activates locomotion behaviors. The deliberative control (see willed control in the figure) will be used in these experiments to guide the exploration process. This can be done in 2 ways. In the supervised autonomy approach a human supervise would interact with the system in order to set new goals or direction for the exploration. In the proposed cooperation with A3-[MultiBot], which is located at the Albert-Ludwigs-Universität Freiburg, mapping data obtained from this ReactiveSpace project will be used to reduce the complexity of the problem of self localization in multirobot environments.

Co-Workers : Thomas Wirth

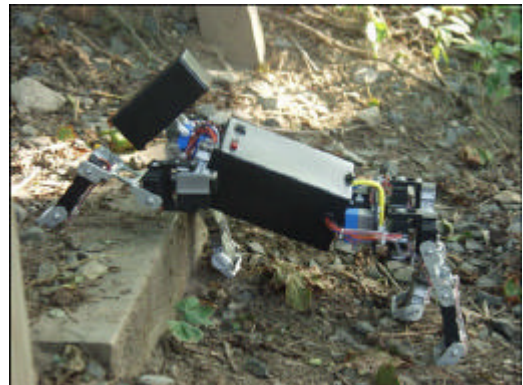
Sponsors : DGF (Deutsche Forschungsgesellschaft)
www.dfg.de



SFB Projekt: Spatial Cognition
www.sfbtr8.uni-bremen.de



Cooperations : Albert-Ludwigs-Universität Freiburg



More information and pictures you will find at www.roboter-info.de .
Furthermore at the Web-Sites of University of Bremen:

<http://ag47.informatik.uni-bremen.de/eng/projekt.php?id=5&details=ja>