Studying Emotion and Interaction between Autonomous Cognitive Agents in Simulated and Robotic Environments

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The MicroPsi Framework

The Psi theory of Dietrich Dörner (Dörner 1999, Dörner et. al. 2002) is an attempt at a *unified architecture of cognition*; originating in psychological modeling, it proposes functional models of representation, action regulation, emotion, memory and perception. While the classical cognitive architectures (ACT, see Anderson and Lebière 1998, Soar, see Laird, Newell, & Rosenbloom 1987, EPAM, see Gobet et al. 1997) primarily focus on symbolic models of cognitive processes and tend to study these processes in isolation, the Psi theory directs its attention instead on the modulation of cognition by motivational and emotional processes and the resulting relationship of an individual to its environment, specifically with respect to affordances (Gibson, 1977). Thus, it is less interested in modeling problem solving paradigms and more keen on examining situated agents in interaction with an environment and each other. Dörner's work has lead to several agent implementations, primarily to model the influence of emotional processes on the execution complex tasks, which has been compared to emotional modulation in human subjects.

In recent years, we have developed MicroPsi, a framework for representation and interaction of agents based on the Psi theory in the context of Artificial Intelligence, which has been used for the simulation of autonomous, motive-based knowledge acquisition in simulated agent environments and as a control architecture for robots (Bach 2003, Bach and Vuine 2003).

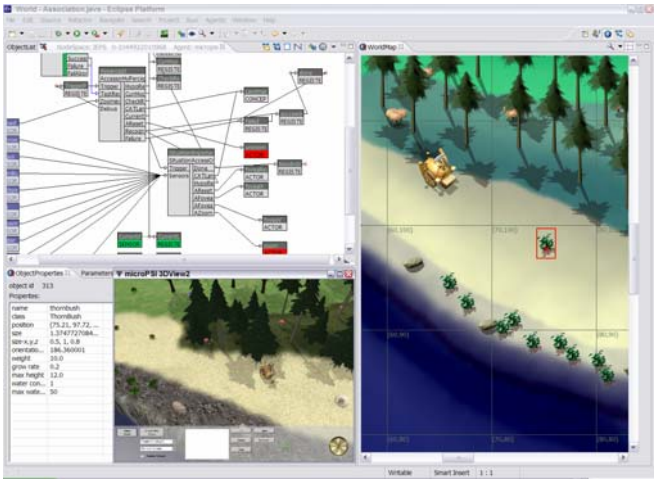

Figure 1: MicroPsi framework.

The goal of MicroPsi is the transformation of the Psi theory into a cognitive architecture by supplying formal models of Psi concepts and a toolkit to define agents based on the theory, conduct experiments and evaluate them. The toolkit is platform independent and consists of graphical editors for agents and their environments, a 3D viewer of the agent world, tools for performing evolutionary experiments, interfaces for robots.

MicroPsi agents are defined using hierarchical spreading activation networks, which make up their control structures, knowledge representation and learning mechanism, all combined in a homogenous architecture. Current work is concerned with object classification in simulated environments, simulation of emotional configurations during action execution and agent interaction, and joint exploration tasks in simulated and robotic environments.

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