

Computational modeling of mechanisms of creativity

The main objective of the project is to systematically investigate creativity mechanisms by designing and implementing a computational model of creative problem-solving which has integrated planning, perception and memory aspects, and is highly parallel, and is inspired by human cognition and brain architecture. We will also investigate the practical applicability of the system to the support of human creativity, and to the use of web-based knowledge.

The overall purpose of the project is to try to understand the properties of creativity in general as an abstraction, extension, and generalization of human creativity. It seems that human creativity is not a special ability but is achieved using common cognitive abilities. Creativity mechanisms include dynamic goal-setting and goal-changing, the generation of alternatives, with variable degrees of constraint, and the efficient search of large sets of possibilities. Generation is by construction, combination, merging and synthesis operations. Analogy and metaphor are important mechanisms, as are abstraction, combination and merging of concepts. Creativity involves the revision, re-representation, restructuring and reconstrual of the problem. Evaluation of possibilities is important and involves multiple constraints in multiple perspectives. Metacognition can be useful in the conscious control and management of the creative process.

Our design is based on an existing brain-based cognitive model which has a perception-action hierarchy with a set of processing modules which interact and execute in parallel. We argue that our proposed modular processing architecture lends itself naturally to creative problem solving by providing (i) different types of representations which mutually interact, allowing large (“lateral”) changes of representation, (ii) a planning and metalevel planning regime which allows flexible exploration of alternatives, restructuring, and selection of representation type, and (iii) an episodic memory facility which allows the history of the problem solving process to be used in planning further problem solving actions.