



Embodied Cognition and The Philosophy of Artificial Life

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Bates College
W.P. Seeley

The term *artificial life* refers to research in artificial intelligence that uses computer simulations of simple sensori-motor systems, robotics, and genetic algorithms to model the kinds of flexible and adaptive autonomous behavior constitutive of our conception of intelligence. Standard computational theories of mind model intelligent behavior on the human capacity for rational decision making and general problem solving. On this account thoughts are constructed from abstract symbols that represent aspects of the environment, and minds are treated as general purpose symbol manipulation systems that can be realized in any of a potentially infinite number natural organisms or artificial systems. Although the computational model of mind has been a powerful research tool in cognitive science, it has proven difficult to implement in computer simulations and mobile robotics. For instance, general purpose problem solvers fall prey to what is called *the frame problem* in artificial intelligence: they have difficulty filtering task salient information out of noisy signals and so often follow inefficient procedures or get stuck in blind alleys. This and other difficulties have inspired researchers in embodied cognition and artificial life to look towards insect and animal models for alternatives. Bodies evolve in lock step with cognitive systems, and both can be thought of as adaptations fine-tuned to the kinds of environmental features necessary to help satisfy an organisms' basic needs and interests. As a result the general structure of an organisms' body (i.e., its effectors and the structure and placement of its peripheral sensory organs) is a strong constraint on the ways it acquires, manipulates, and uses information from its environment – a constraint that focuses cognitive systems on task salient information in the environment, simplifying the computational demands of flexible and adaptive behavior. Researchers in embodied cognition and artificial life therefore challenge the assumption that minds are general purpose symbol manipulation systems. They argue instead that intelligent behavior emerges from the interaction between (well adapted) bodies and the environment. To this end research in autonomous (sometimes called agent- or behavior-based) robotics is used to explore the role of agent-environment interactions in the production of intelligent behavior. *Embodied Cognition and The Philosophy of Artificial Life* explores this approach to understanding intelligence. Readings are drawn from contemporary sources in philosophy, psychology, neuroscience, and computer science. In addition to course readings and written assignments, students use a range of computer simulations and robotics exercises to explore the ideas introduced in class. Topics covered include: the nature of intelligence, the computational theory of mind, embodied cognition, representation, classic AI, behavior-based robotics, neural networks, genetic algorithms, dynamic systems, and the role played computer simulations and robotics in cognitive science