Implementation of an Empirical Robot Model of Discrimination Learning

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Starting from the successful example of biorobotics, we have proposed a new methodology to use autonomous agents as empirical models in cognitive science, called *comparative cognitive robotics* (CCR) (John & Werner, 2004). As one application of our new methodology, we have implemented a robot model of visual discrimination learning in chickens (*Gallus gallus* fd). Experiments on the discrimination of integral and separable visual compound stimuli and of dimensional stimuli were carried out with chickens. The guiding hypothesis of our empirical and robot modeling work is that (1) no feature abstraction process has to be assumed prior to learning; previously seen and current stimuli are rather learned and compared as whole, unanalyzed patterns and that (2) this same most simple mechanism can account for the reaction to all types of stimuli used in our experiments. The empirical results of this and our prior animal experiments clearly speak in favor of this hypothesis (Werner & Rehkämper, 1999, 2001; Werner, Tiemann, Cnotka & Rehkämper, 2005). As an additional test of the hypothesis, we equipped a robot model with a simple exemplar-based learning mechanism and have started to replicate the same experiments in the same experimental environment with this robot model. The only change made was that rather than access to food, a light signal served as reinforcement for the robot. In all experiments carried out until now, the robot model delivered the same patterns of behavioral data as the animals. By implementing our hypothesis in the form of a robot model and testing it under the same conditions, we were thus able to show that our hypothesis can indeed explain the performance of the animals in the behavioral experiments, even under non-idealized, real-world conditions. In addition, the same simple exemplar-based learning mechanism has recently been shown to work in a different robot in a more complex learning environment (Türkmen, 2005).

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