

A Reading of  
Maja J. Mataric's  
Getting Humanoids to Move and Imitate

Mataric builds on two inspirations from biology in designing a humanoid robot motor control system: *spinal fields* and *mirror neurons*. Spinal fields code primitive motor behaviors that serve as building blocks for more complex behaviors in the organism. As such they somewhat resemble Mataric's "basis behaviors" which act as similar building blocks in complex robot behavior patterns. Mirror neurons are brain cell constructs that correspond to both perception and activation of motor activity, playing a central role in imitation.

In Mataric's artificial version of the spinal fields/mirror neuron framework, human movement is detected using a combination of vision, magnetic field and telemetry suit processing. Relevant movement is found through an attention selection mechanism that is based on expected motions, which in turn is based on the motor primitives known to the humanoid. This data is then coded and normalized and subsequently classified into a parametric set relating to the motor primitives known to the robot. These motor primitives and combinations thereof are then used to create imitative and possibly novel behavior. It should be noted that experimental results herein focus on imitation and do not demonstrate extraction or creation of new actions.

While much of the architecture described in the paper is not implemented, I felt that the central principle employed in this work is worthwhile: that of using knowledge about self and possibly motor configurations to steer the the perception system. This creates a feedback loop using behavior primitives to classify detected motion and using detected motion to enrich the behavior set. If taken a step further, this principle can also incorporate new learned behaviors into the perception system, using this feedback loop to result in growth.

Possibly the most prominent drawback of this work is its apparent restrictiveness. While postulated in the architecture part of the paper, it is not shown how new behavior primitives can be evolved from existing ones or how truly new behavior can be accommodated for. The presented architecture also seems confined to very specific motor learning, not allowing for generalization or higher-level learning. I believe a task-oriented approach needs to be considered in addition to the framework described herein to reach a more complete learning architecture.