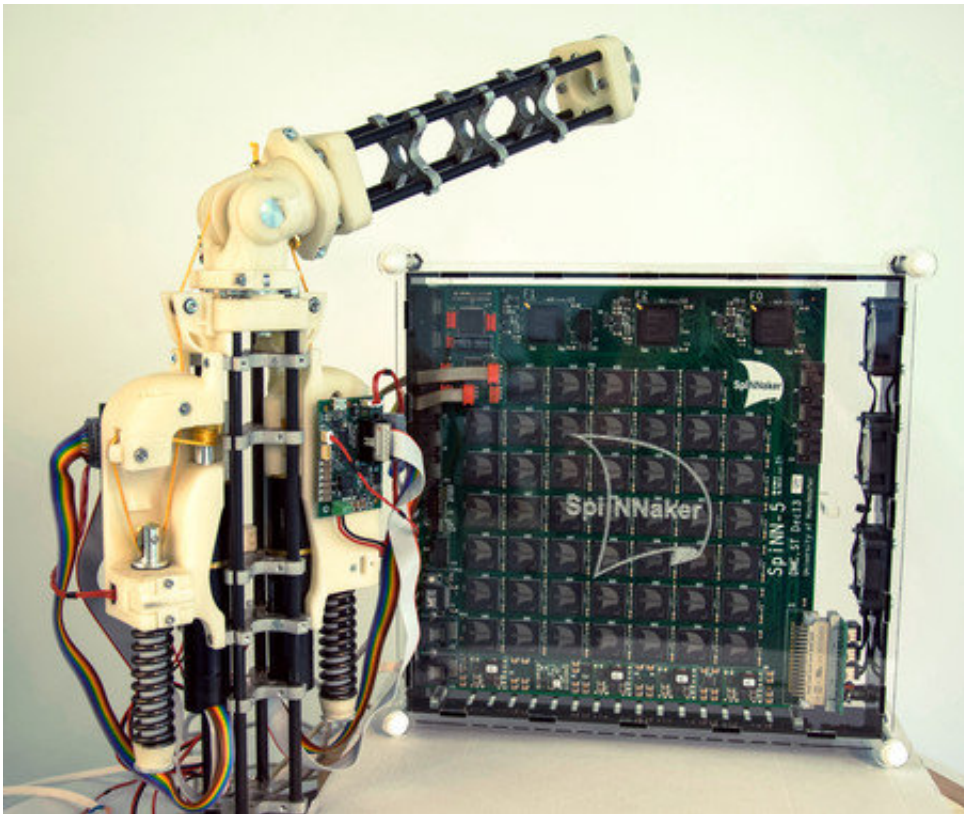


Scientists develop robot with learned motor control

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A simpler Myorobotics arm connected to the neuromorphic computer platform SpiNNaker. Credit: Sören Jentzsch

The two main pitfalls of robots that imitate the human body are control and cost. Researchers from the MoCoTi European project have designed a prototype of a robot that learns how to actuate its own limbs, and that can be easily duplicated. The device, consisting of a control system and a

tendon-driven robotic arm, might be the first step toward low-cost humanoid robotics.

Robots that behave and feel similar to humans are becoming a reality. They are made up of musculoskeletal hardware that imitates the [human body](#) and neural control software that simulates parts of the brain. However, producing them in series in a viable manner is difficult.

Now, scientists have created a low-cost robot that can be easily reproduced. "This is possible because its modular design permits relatively efficient mass production," says Christoph Richter, lecturer at the department of Electrical and Computer Engineering of the Technical University of Munich (Germany).

In order to imitate the muscles and articulations of the human arm and give the robot increased mobility, the scientists have used the Myorobotics system. Nine muscles formed of mechatronic devices are coordinated to control spherical articulation. One of these, linked to the biceps, is joined to two articulations connecting the shoulder to the elbow.

The next step is to design an artificial cerebellum to control the orders from the locomotor system. "The neuronal structure of the cerebellum is relatively simple and uniform. We reproduce the most important neurons, their connectivity and – importantly – their adaptation and learning in our real-time simulation," states Richter.

To copy their behaviour, the researchers selected a neuromorphic computer platform called SpiNNaker developed at the University of Manchester (United Kingdom). Its performance is far superior to a desktop computer: A single chip can manage a network of 10,000 neurons in real time. Thousands of chips can be interconnected to simulate sizeable, brain-scale neuronal networks.

The prototype learns to move in a controlled manner, "including the timing and control of posture," says Richter. Its advantages include its elasticity and that it can be controlled, an important aspect in the human-[robot](#) interaction.

According to the researchers, it is possible to incorporate higher-order brain structures such as the cortical networks and neuromorphic vision and hearing, using so-called silicon retina or cochlear sensors. Robots of this type, with increasingly more realistic simulations, will be a very useful tool for studying the brain, say the scientists in a paper published in *IEEE Robotics & Automation*.

More information: Christoph Richter et al. Musculoskeletal Robots: Scalability in Neural Control, *IEEE Robotics & Automation Magazine* (2016). [DOI: 10.1109/MRA.2016.2535081](https://doi.org/10.1109/MRA.2016.2535081)

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