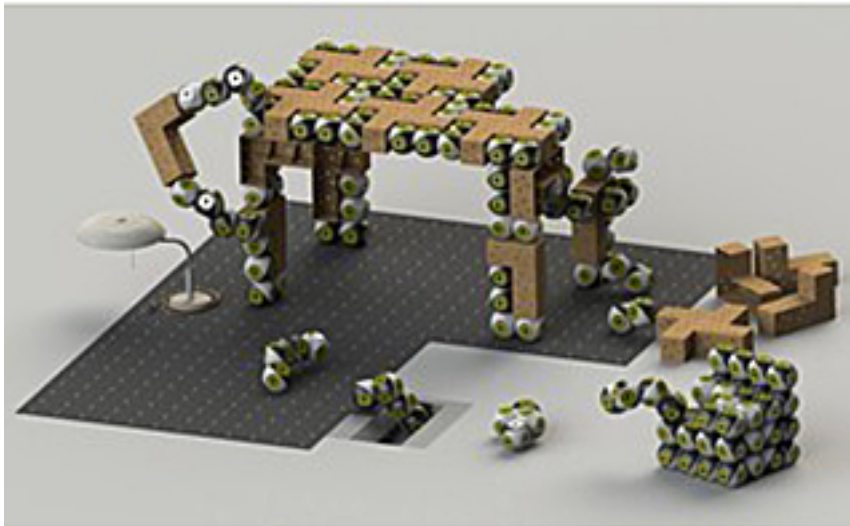


Robots Transform into Furniture

EPFL



Scientists are creating futuristic furniture that can move around and autonomously change its shape, an innovation that may prove useful to support disabled individuals. EPFL Biorobotics Laboratory (BIOROB) researchers have developed small robotic modules that can change their shape to create reconfigurable furniture.

"Eventually, all you'll need to do is program the layout of a bedroom or a conference room, then let the modules do the work," says Auke Ijspeert, head of the BIOROB. His "Roombots" project, co-funded by the National Centre for Competence in Research Robotics, is the subject of an article that has been published in the online version of the journal *Robotics and Autonomous Systems*.

Retractable claws

Like Lego bricks, Roombots pieces can be stacked upon each other to create various structures. Each 22-centimeter-long piece, which looks like two large dice joined together, has a wireless connection. Inside are a battery and three motors that allow the module to pivot with three degrees of freedom. The modules have retractable "claws" that they use to attach to other pieces and form larger structures. With a series of rotations and connections, the modules can change shape and become any of a variety of objects and pieces of furniture. "In order to keep costs down and ensure solidity, we have prioritized the construction of hybrid furniture, in other words, objects made up of both robotic modules and solid "passive" elements," says Auke Ijspeert.

In order to metamorphose and to attach to passive elements, the Roombots need to anchor themselves to something, so the researchers developed a special surface with holes adapted to the Roombots' mechanical claws. Fixed to the walls, floor and already existing pieces of furniture, these surfaces act as interfaces between the

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modules and their environment. The little robots can then climb the walls of a room, or attach themselves to "passive" elements on the furniture to form mobile tables or lamps that follow you around the room. "It could be very useful for disabled individuals to be able to ask objects to come closer to them, or to move out of the way," notes Auke Ijspeert.

An aesthetic appeal

The Roombots project is a true technological challenge, and for the moment it includes four functional modules with an autonomy of one-hour — still not enough to create complete pieces of furniture, but enough to build simple structures and hybrid combinations.

The potential for innovative applications is huge. Students from the French national school for advanced studies in design (ENSCI Les Ateliers) have risen to the challenge put out by Ijspeert's lab, with the help of EPFL Ecal-Lab, and come up with some concepts. Their ideas, shared via a series of [videos](#) [1], pique the imagination: flower pots that can move from window to window around the façade of an entire building; Roombots that make lighting components and sound systems modular and adaptable are just two examples.

"We designed the Roombots elements in such a way that they blend into the background of a room and make the users' lives easier, while maintaining a certain aesthetic quality," says Ijspeert. "We're open to any possibility."

Programming a floor plan from a tablet

There are still a few technical details that need to be smoothed out. The movement of the modules when they're grouped needs to be accelerated and optimized, and the algorithms defining the sequences of motor actions involved in composing the various structures need to be improved. The scientists are also busy testing various user interfaces.

"One idea is to use a tablet on which you could define the layout of a virtual room. The Roombots would then take care of the rest," says Stéphane Bonardi, a Ph.D. student involved in the project. In the next few years, the laboratory will continue the fabrication of modules. Perhaps the not-so-distant future will find us living in a world made up of intelligent buildings, with furniture that arranges and adapts itself to meet our every need.

[*Roombots: A hardware perspective on 3D self-reconfiguration and locomotion with a homogeneous modular robot*](#) [2]

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[1] <http://vimeo.com/68054651>

[2] <http://www.sciencedirect.com/science/article/pii/S0921889013001632>

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