

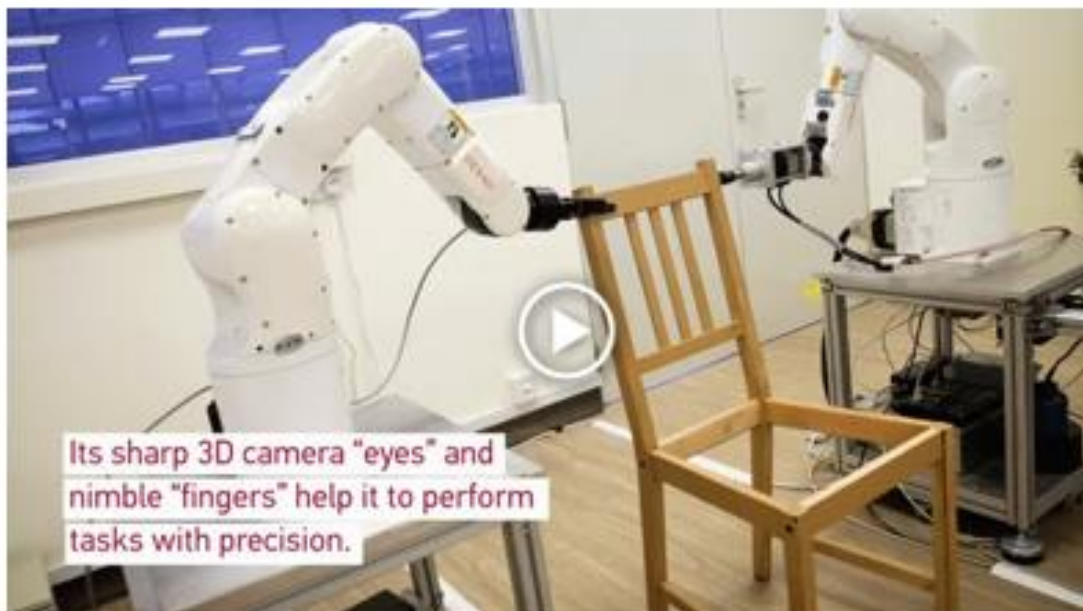
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# Robot is taught how to assemble Ikea furniture — doesn't complain once

It has an advantage over people — it pays attention to the directions.

By Niraj Chokshi New York Times

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Video (00:55) : A team from Nanyang Technological University has programmed a robot to put together Ikea's \$25 solid-pine Stefan chair.

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Robots have taken our jobs, learned our chores and beaten us at our own games.

Now researchers in Singapore say they have trained one to perform another task known to confound humans: figuring out how to assemble Ikea furniture.

A team from Nanyang Technological University has programmed a robot to put together Ikea's \$25 solid-pine Stefan chair. Chairs are tricky to assemble, the researchers said, meaning that getting the robot to move on to things like desks and bookcases should be relatively easy.

In order to build the chair, the robot's creators needed to incorporate a medley of human skills, they explained in the journal *Science Robotics*.

“If you think about it, it requires perception, it requires you to plan a motion, it requires control between the robot and the environment, it requires transporting an object with two arms simultaneously,” said Quang-Cuong Pham, an assistant professor of engineering at the university.

It’s also a task to which most people can relate.

Putting together Ikea furniture is “something that almost everybody is familiar with and almost everybody hates doing,” said Ross Knepper, an assistant professor of computer science at Cornell University, whose research focuses on human-robot interaction.

The Nanyang research team said that their work has applications well beyond putting together a chair for your kid’s dorm room. The steps involved in assembling furniture can mimic the manipulations robots do now or someday might perform on factory floors.

Chairs, with backs, stretchers and other parts, pose a complex challenge; hence the interest of the researchers.

Their robot involved custom software, a three-dimensional camera, two robotic arms, grippers and force detectors. Beyond that, the team chose only off-the-shelf tools that would be available in a typical home.

Like humans, the robot was given the assembly instructions before it began. Unlike humans, it didn’t ignore them.

The robot proceeded in three phases, spread out over 20 minutes 19 seconds.

First, it studied at the pieces scattered before it. The robot photographed the scene and matched each part to the one modeled in the instructions.

Then, over more than 11 minutes, the robot devised a plan that would allow it to quickly assemble the chair without its arms knocking into each other or into the various parts.

Finally, it put the plan in motion. The actual assembly took about nine minutes. The robot used grippers to pick up the wooden pins from a tray and force sensors at its “wrists” to detect when the pins, searching in a spiral pattern, finally slid into their holes. Working in unison, the arms then pressed the sides of the chair frame together.

It should be noted that the robot didn’t scrape its knuckles, lose any parts or curse during the process. There are, it appears, still limits to just how humanlike a machine can be.