Robots Continue Attempting to Master Ikea Furniture Assembly

These robots are slow, careful, and successful, making them way better than humans at assembling an Ikea chair
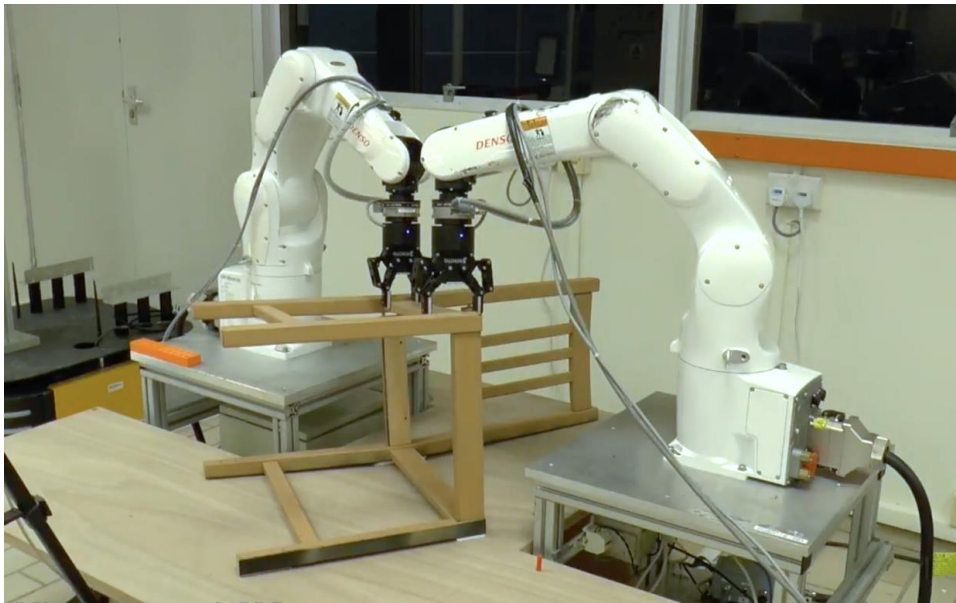
By Evan Ackerman

Image: NTU

Apparently, one of the standards by which we should be measuring the progress of useful robotic manipulation is through the assembly of Ikea furniture. With its minimalistic and affordable Baltoscandian design coupled with questionably creditable promises of effortless assembly, Ikea has managed to convince generations of inexperienced and desperate young adults (myself included) that we can pretend to be grownups by buying and putting together our own furniture. It's never as easy as that infuritatingly calm little Ikea manual dude makes it look, though, and in terms of things we wish robots would solve, Ikea furniture assembly has ended up way higher on the priority list than maybe it should be.

We've seen a variety of robotic systems tackle Ikea in the past, but today in *Science Robotics* is (perhaps for the first time) a mostly off-the-shelf

system of a few arms and basic sensors that can put together the frame of a Stefan chair kit autonomously(ish) and from scratch.

This research comes from the <u>Control Robotics Intelligence (CRI) group at NTU in Singapore</u>, and they've been working on the whole Ikea chair assembly thing for a while. First, they had to teach robots to insert those wooden pins that Ikea uses to connect parts to one another.

Then you've got multiple pin insertion under uncertainty.

Next, cooperatively moving partially assembled chair pieces around.

And finally, bimanual whole-chair manipulation.

The research being presented today in *Science Robotics* is essentially a synthesis of these skills, all put together resulting in a fully autonomous Ikea chair frame assembly.

To help put this research in perspective, let's briefly take a look at a few other attempts at Ikea furniture assembly by robots, both from 2013:

IkeaBot:

<u>IkeaBot in particular is notable because it's fully autonomous</u>— the system doesn't require human input of any sort, not even instructions. Rather, it uses a reasoning system to determine the best way to fit all of the parts together, utilizing all available holes for fasteners and all available parts, and follows its own optimized assembly technique to end up with a piece of furniture that ends up being what Ikea intended it to be almost by default.

The assembly process from CRI is not quite that autonomous; "although all the steps were automatically planned and controlled, their sequence was hard-coded through a considerable engineering effort." The researchers mention that they can "envision such a sequence being automatically determined from the assembly manual, through natural-language interaction with a human supervisor or, ultimately, from an image of the chair," although we feel like they should have a chat with <u>Ross Knepper</u>, whose IkeaBot seemed to do just fine without any of that stuff.

What is different about this new research is that it relies on very simple (deliberately simple) COTS (commercial off the shelf) hardware. There are two Denso industrial arms, Robotiq parallel grippers, force sensors, and a single depth camera. The system used no fiducials and no motion tracking, and although it did take 20 minutes (11 minutes of which was motion planning), randomly scattered chair parts were successfully turned into a chair frame in one single take. And really, 20 minutes is not that long— not even long enough to enjoy a surprisingly affordable meal of traditional meatballs with a side of lingonberries.

And in case you were wondering whether robots are fundamentally better at putting together Ikea furniture than you are, this should make you feel (a little bit) better:

Too bad all of those clips cut out just before the robot grabs the piece and throws it against the wall while screaming incoherently.