

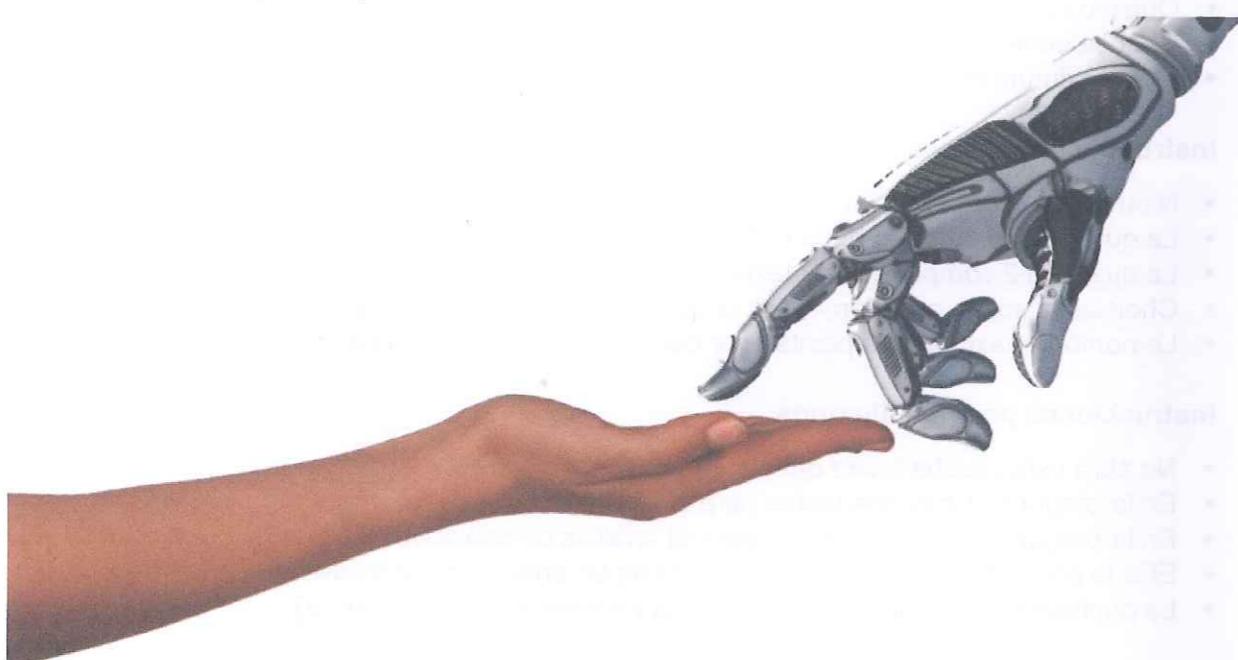
- In what ways is this text written and constructed to appeal to a wide audience?

FEATURE ROBOTICS, SCIENCE & SOCIETY

## For robots, artificial intelligence gets physical

To work with humans, machines need to sense the world around them

BY MEGHAN ROSEN 5:16PM, NOVEMBER 2, 2016



ROBOT AWAKENING By giving robots physical intelligence, researchers hope to build machines that can work alongside humans.

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In a high-ceilinged laboratory at Children's National Health System in Washington, D.C., a gleaming white robot stitches up pig intestines.

The thin pink tissue dangles like a deflated balloon from a sturdy plastic loop. Two bulky cameras watch from above as the bot weaves green thread in and out, slowly sewing together two sections. Like an experienced human surgeon, the robot places each suture deftly, precisely — and with intelligence.

Or something close to it.

For robots, artificial intelligence means more than just "brains". Sure, computers can learn how to recognize faces or beat humans in strategy games. But the body matters too. In humans, eyes and ears and skin pick up cues from the environment, like the glow of a campfire or the patter of falling raindrops. People use these cues to take action: to dodge a wayward spark or huddle close under an umbrella.

10 Part of intelligence is "walking around and picking things up and opening doors and stuff," says Cornell computer scientist Bart Selman. It "has to do with our perception and our physical being". For machines to function fully on their own, without humans calling the shots, getting physical is essential. Today's robots aren't there yet — not even close — but amping up<sup>1</sup> the senses could change that.

15 20 "If we're going to have robots in the world, in our home, interacting with us and exploring the environment, they absolutely have to have sensing," says Stanford roboticist Mark Cutkosky. He and a group of like-minded scientists are making sensors for robotic feet and fingers and skin — and are even helping robots learn how to use their bodies, like babies first grasping how to squeeze a parent's finger.

25 30 The goal is to build robots that can make decisions based on what they're sensing around them — robots that can gauge the force needed to push open a door or figure out how to step carefully on a slick sidewalk. Eventually, such robots could work like humans, perhaps even caring for the elderly.

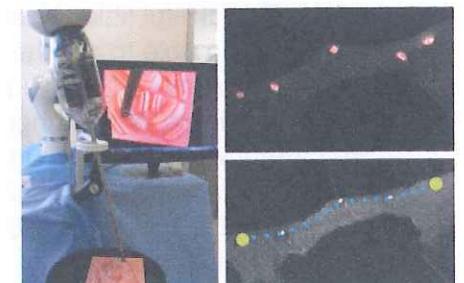
35 Such machines of the future are a far cry from that shiny white surgery robot in the D.C. lab, essentially an arm atop a cart. But today's fledgling<sup>2</sup> sensing robots mark the slow awakening of machines to the world around them, and themselves.

"By adding just a little bit of awareness to the machine," says pediatric surgeon Peter Kim of the children's hospital, "there's a huge amount of benefit to gain."

Adapted from Science News, [www.sciencenews.org](http://www.sciencenews.org) (2016)

### Delicate touch

A surgical robot (left, shown practicing on a silicone pad with the texture of human tissue) is guided by fluorescent dots marked by a researcher (top right). The bot uses a 3-D camera and near-infrared imaging plus preprogrammed surgical knowledge to map out its suturing plan (bottom right — blue dots show stitches, green dots are knots and white dots are the researcher's fluorescent marks).



RYAN DECKER/CHILDREN'S NATL. HEALTH SYST. BOTH ON RIGHT: AZAD SHADEMAN ET AL./SCIENCE TRANSL. MED. 2016

<sup>1</sup> amping up: increasing the power or force

<sup>2</sup> fledgling: emergent