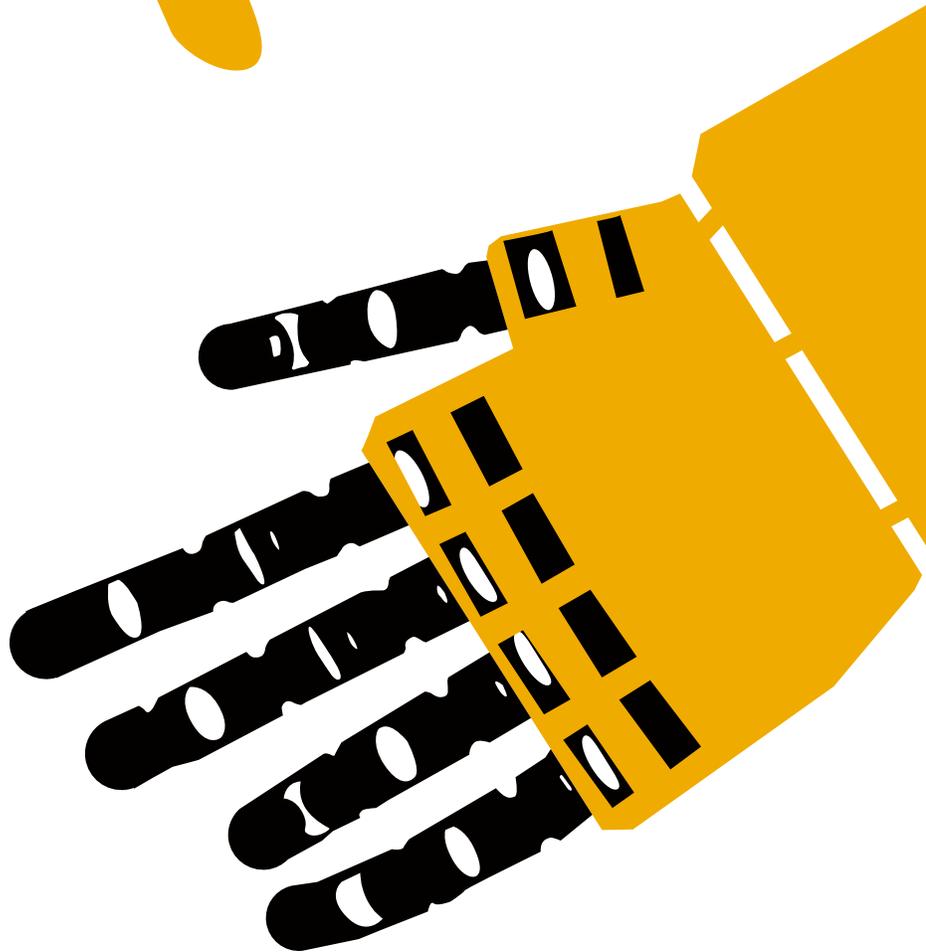
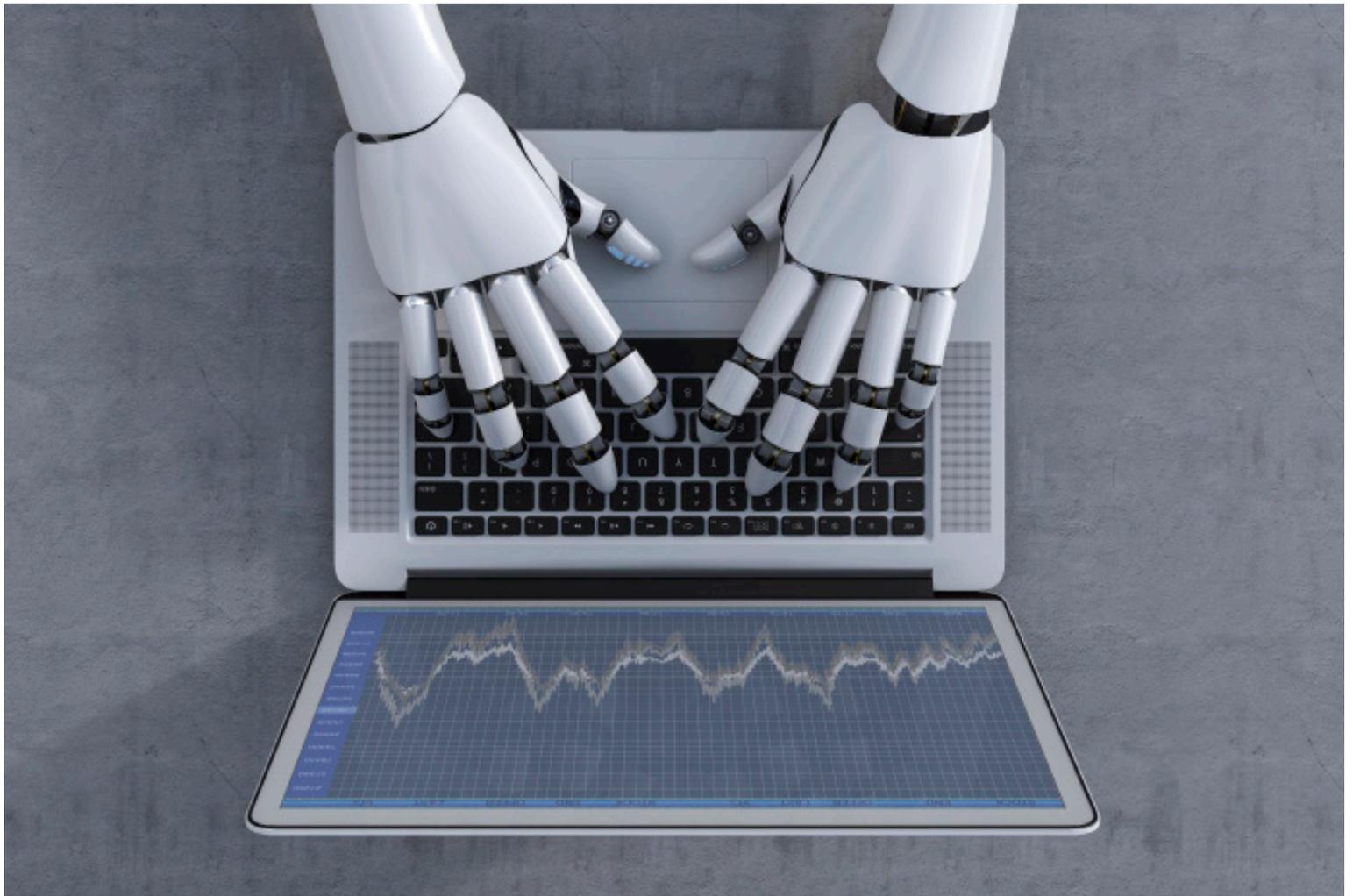




The Robotics Race

ROBOTS ARE EVOLVING INTO OUR COLLABORATORS, EXTENSIONS, AND, YES, REPLACEMENTS AT A PACE THAT WILL BOTH INSPIRE AND CHALLENGE BUSINESS AND SOCIETY TO KEEP UP.





As robotic technologies continue to advance, along with related technologies such as speech and image recognition, memory and analytics, and virtual and augmented reality, better, faster, and cheaper robots will emerge. These machines – sophisticated, discerning, and increasingly autonomous – are certain to have an impact on business and society. But will they bring job displacement and danger or create new categories of employment and protect humankind?

We talked to SAP's Kai Goerlich, along with Doug Stephen of the Institute for Human and Machine Cognition and Brett Kennedy from NASA's Jet Propulsion Laboratory, about the advances we can expect in robotics, robots' limitations, and their likely impact on the world.



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Doug Stephen
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Brett Kennedy
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Q What are the biggest drivers of the robot future?

Kai Goerlich: Several trends will come together to drive the robotics market in the next 15 to 20 years. The number of connected things and sensors will grow to the billions and the data universe will likewise explode. We think the speed of analytics will increase, with queries answered in milliseconds. Image and voice recognition – already quite good – will surpass human capabilities. And the virtual and augmented reality businesses will take off. These technologies are all building blocks for a new form of robotics that will vastly expand today’s capabilities in a diversity of forms and applications.

Brett Kennedy: When I was getting out of school, there weren’t that many people working in robotics. Now kids in grade school are exposed to a lot of things that I had to learn on the job, so they come into the workplace with a lot more knowledge and fewer preconceptions about what robots can or can’t do based on their experiences in different industries. That results in a much better-trained workforce in robotics, which I think is the most important thing.

In addition, many of the parts that we need for more sophisticated robots are coming out of other fields. We could never create enough critical mass to develop these technologies specifically for robotics. But we’re getting them from other places. Improvements in battery technology, which enable a robot to function without being plugged in, are being driven by industries such as mobile electronics and automotive, for example. Our RoboSimian has a battery drive originally designed for an electric motorcycle.

Q Do you anticipate a limit to the tasks robots will be able to master as these core technologies evolve?

Goerlich: Robots will take over more and more complex functions, but I think the ultimate result will be that new forms of human-machine interactions will emerge. Robots have advantages in crunching numbers, lifting heavy objects, working in dangerous environments, moving with precision, and performing repetitive tasks. However, humans still have advantages in areas such as abstraction, curiosity, creativity, dexterity, fast and multidimensional feedback, self-motivation, goal setting, and empathy. We’re also comparatively lightweight and efficient.

Doug Stephen: We’re moving toward a human-machine collaboration approach, which I think will become the norm for more complex tasks for a very long time. Even when we get to the point of creating more-complex

and general-purpose robots, they won’t be autonomous. They’ll have a great deal of interaction with some sort of human teammate or operator.

Q How about the Mars Rover? It’s relatively autonomous already.

Kennedy: The Mars Rover is autonomous to a certain degree. It is capable of supervised autonomy because there’s no way to control it at that distance with a joystick. But it’s really just executing the intent of the operator here on the ground.

In 2010, DARPA launched its four-year Autonomous Robotic Manipulator Challenge to create machines capable of carrying out complex tasks with only high-level human involvement. Some robots completed the challenge, but they were incredibly slow. We may get to a point where robots can do these sorts of things on their own. But they’re just not as good as people at this point. I don’t think we’re all going to be coming home to robot butlers anytime soon.



Stephen: It’s extremely difficult to program robots to behave as humans do. When we trip over something, we can recover quickly, but a robot will topple over and damage itself. The problem is that our understanding of our human abilities is limited. We have to figure out how to formally define the processes that human beings or any legged animals use to maintain balance or to walk and then tell a robot how to do it.

You have to be really explicit in the instructions that you give to these machines. Amazon has been working on these problems for a while with its “picking challenge”: How do you teach a robot to pick and pack boxes the way a human does? Right now, it’s a challenge for robots to identify what each item is.

Q So if I’m not coming home to a robot butler in 20 years, what am I coming home to?

Goerlich: We naturally tend to imagine humanoid robots, but I think the emphasis will be on human-controlled robots, not necessarily human-shaped units. Independent robots will make sense in some niches, but they are more complex and expensive. The symbiosis of human and machine is more logical. It will be the most efficient way forward. Robotic suits, exoskeletons, and robotic limbs with all kinds of human support functions will be the norm. The future will be more Iron Man than Terminator.

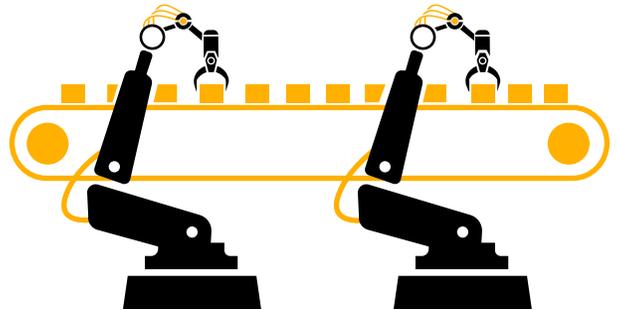
Q What will be the impact on the job market as robots become more advanced?

Goerlich: The default fear is of a labor-light economy where robots do most of the work and humans take what's left over. But that's last-century thinking. Robots won't simply replace workers on the assembly line. In fact, we may not have centralized factories anymore; 3D printing and the maker movement could change all that. And it is probably not the Terminator scenario either, where humanoid robots take over the world and threaten humankind. The indicators instead point to human-machine coevolution.

There's no denying that advances in robotics and artificial intelligence will displace some jobs performed by humans today. But for every repetitive job that is lost to automation, it's possible that a more interesting, creative job will take its place. This will require humans to focus on the skills that robots can't replicate – and, of course, rethink how we do things and how the economy works.

Q What can businesses do today to embrace the projected benefits of advanced robotics?

Kennedy: Experiment. The very best things that we've been able to produce have come from people having the tools and then figuring out how they can be used. I don't think we understand the future well enough to be able to predict exactly how robots are going to be used, but I think we can say that they certainly will be used.



Stephanie Overby is an independent writer and editor focused on the intersection of business and technology.

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