Charting technology's new directions: A conversation with MIT's Erik Brynjolfsson

A leading expert explores the new relationship between man and machine and the challenges that emerge when innovation is decoupled from growth in jobs and incomes.

"We're finally getting at that seminal moment in human history when we can talk to our machines and our machines will understand us in regular, natural language," says Massachusetts Institute of Technology (MIT) professor Erik Brynjolfsson. In this video, he explores the role of big data in business performance, the rise of robotics, and the decoupling of the historical relationship between gains in productivity, incomes, and jobs. He is the coauthor, with MIT research scientist Andrew McAfee, of *Race Against the Machine* (Digital Frontier Press, October 2011). This interview was conducted by McKinsey Publishing's Rik Kirkland. What follows is an edited transcript of Brynjolfsson's remarks.

Technologies to watch

We see a slew of amazing innovations already in the pipeline. We've had a chance to look at some of them. A few of them are beginning to have significant effects now, and I think more of them will have even bigger effects in the next five or ten years. Obviously, big data has got to be at or near the top of that list.

Andy [Andrew McAfee] and I have done a lot of work on looking at how big data is changing companies. It's very striking to us how the companies that are measuring their operations more carefully, taking these very large volumes of data and creating more analytical types of management practices, are dramatically outperforming their competitors.

We've spent some time looking at different kinds of robotics. For instance, our friend Rodney Brooks has a company called Rethink Robotics. We play with a robot called Baxter, and it works for less than $4 an hour, and can do a lot of basic, routine manual tasks. And the big advances there

were improvements in vision; sensory systems, more generally; touch; relatively fine motor control; and it can work more autonomously than other robots.

Another very striking example is the Google self-driving car. I had a thrilling experience riding down Route 101, and at first, it was kind of scary because you're just sitting there and there's no driver. But then, after a while, you kind of feel like, "Hey, this is kind of cool." And by the end of the ride, I think I was almost bored. It was like, "Hey, this is driving so smoothly and confidently, I almost feel more secure in this car." In fact, I did feel more secure in that car than I did riding with a typical Boston taxi driver.

Another big category is in using different kinds of artificial intelligence to answer questions. We had IBM's Watson supercomputer come and play our team of MIT students, and Watson completely kicked their butt playing *Jeopardy!* But, of course, they didn't build it just to win $75,000 at *Jeopardy!* They have it answering questions at call centers—a whole variety of unexpected questions. They have it doing medical diagnoses, legal recommendations, and financial- services recommendations.

And I can just see a plethora of opportunities there to answer all sorts of unstructured queries from very large data sets in a way that not just matches but exceeds human capabilities. And there are a lot of jobs that are going to be affected by that, and a lot of wealth that can be potentially created from that.

Man and machine

I think we're finally getting at that seminal moment in human history when we can talk to our machines and our machines will understand us in regular, natural language. It's a little clunky if you use Siri or some of the automated voice-response systems. At first, you're kind of amazed by a few things you can do, but you quickly run into the boundaries and it can be a little frustrating. But it's advancing very, very rapidly.

And to tie it back to one of the technologies I mentioned earlier, the big breakthrough has been linking it to big data. You now have hundreds of millions of people using that, talking to it and correcting it. It creates a closed-loop learning system where these voice systems (not just Siri but Google and the others) are learning much more rapidly than they could in the past. And just by crunching large amounts of data, they're able to improve language understanding in a way that we couldn't when we were sort of trying to hand code the semantics and syntax of language in the first era of language recognition.

So I could go on, but those alone would be enough to revolutionize my life, and I think everyone's life. But in terms of economic impact, some of the biggest impacts will be getting machines to do

things that humans can't do, or that are very different. The old saw is that we didn't make machines fly by flapping their wings, and cars don't walk on their wheels. They use very different methods, and, as a result, can exceed our capabilities in dramatic ways. And then, of course, they're weaker in other ways.

That does leave these sort of interesting weak spots that they have, and the nice thing is that it means humans and machines are complementary. Machines aren't perfect or even very good substitutes for humans in some areas. But by working together, by racing with machines, we can do more than the machines by themselves or humans by themselves could do.

If you just look at simple games like chess, everyone knows now that the best chess player in the world is not a human. But what they may not know is that it's not a computer either. It's actually a team of humans and computers playing together that can beat the best computer playing chess or the best human playing chess.

And that's a good kind of microcosm of this idea of racing with machines. There are a number of companies trying to create new business models where they use technology to bring people together and solve problems that couldn't previously be solved.

Productivity paradox

Innovation has never been faster. And in fact, if you look at the underlying statistics, productivity growth is doing pretty well. Productivity levels are at an all-time high, and in the 2000s, productivity growth was faster than it was in the 1990s, which was a great decade.

On the other hand, you have the median worker doing worse. And the median household and the median worker in the United States have lower incomes today than in 1997. What's more, the employment-to-population ratio has fallen; it's almost like falling off a cliff. And similar things are visible in the OECD[1] statistics for nations around the world. And that is exactly the great paradox of our era.

Now, the way that we came about to resolve that was to make a key observation, and that is that there is no economic law that says that technological progress needs to benefit everybody, or even that it needs to benefit a majority of people. It's entirely possible for technology to advance, to make the pie bigger, and yet for some people to get a smaller share of that pie.

And in essence, that's what's been happening, especially over the past 10 or 15 years. Historically, productivity and employment and median income have all grown together. And I recently wrote an article called "The Great Decoupling"[2] where you see how these trends map each other all through the 20th century, and then they start separating in the late 1990s, in particular. So from

[1] Organisation for Economic Co-operation and Development

[2] Erik Brynjolfsson and Andrew McAfee, "The Great Decoupling," *New Perspectives Quarterly*, 2013, Volume 30, Number 1, pp. 61–3.

that data, it does appear that we're in a new era, in the sense that these technologies are behaving differently.

In fairness, technology has always been creating jobs, and it has always been destroying jobs. Go back to 1800 when on the order of 90 percent of Americans worked on farms. Now it's less than 2 percent. Of course, all those people didn't just become unemployed. As technology automated threshing, those jobs were replaced by new jobs. Henry Ford helped create the auto industry. Steve Jobs, Bill Gates, and many others helped create the computer industry, and numerous other occupations rose up that we never could have thought of before. And so people moved from one area to another.

You'd like to see that happening again now. But the data show that it just isn't happening as fast. We're having the automation and the job destruction; we're not having the creation at the same pace. There's no guarantee that we'll be able to find these new jobs. It may be that machines are better than that.

That said, I'm not sure that's a bad thing, because ultimately the purpose of economic progress and technological progress is to be able to create more wealth with less work. I mean, isn't that what we want? More wealth with less work? So, if we are in a *Star-Trek* economy, where replicators create all the essentials that we need, that doesn't have to be a bad thing if we can have an economic system that matches to it and find a way that people can share in that benefit. And people can still continue to find meaning and value in life.

And we may, in the coming decades, be confronted with that question of how we create an economic system that adapts and changes as rapidly as our technological system has changed. ▢

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