We're speaking today with Eric Brynjolfsson, a professor here at MIT Sloan School of Management, the director of the MIT Initiative on the Digital Economy, and co-author of a bestselling book, The Second Machine Age, a book that really has gotten the conversation going about how important today's digital economy is, how the technologies that are coming along are going to have an enormous effect on the future of work. So Eric, thank you for joining us.

It's a real pleasure.

Good. Let's get started. Why don't you tell us why you think the current technological wave of innovation is as important as the first Industrial Revolution, with the steam engine and all the things that went with it.

Well, you know, technologies make a huge difference in the living standards of people. For centuries, living standards were essentially stagnant until James Watt and others developed a better steam engine, and that ignited the Industrial Revolution. And ever since then, living standards have been growing about 2% per year, which adds up to a lot.

What those technologies really did was they augmented and automated a lot of muscle power from humans and animals to machines. What we're seeing now is that machines are beginning to be able to do the same thing for our brains and our minds. We have computers and software and big data that are learning how to help us make decisions, how to extend our mental capacity. And that's at least as profound a difference as what the steam engine and, later, the internal combustion engine and other technologies did for our muscles.

Well, it's very clear that technological changes like this are very good for the economy, but they also affect work. Tell us a little bit about how technologies affect work in what ways-- in positive ways, in negative ways-- and then we can go on from there.

Sure. Well, the big headline is the first one you mentioned, that the pie is getting bigger. And so we have to keep sight of that, that basically these are technologies that create more abundance, more wealth. And there's more wealth now than there ever has been in history, and global poverty is going down. So that's the good news.

But the reality is that there's no economic law that says that everyone's going to benefit evenly from this. It's possible for some people to be made worse off. In fact, there's no economic reason that you couldn't have a majority of people be made worse off, even as other people get much, much better.

Through most of history, there was a rising tide that lifted most boats, almost all boats. But in the past 20 years or so, there's been what we call a decoupling, where productivity has continued to grow, GDP per capita has

continued to grow, but the median income, the 50th percentile and those below it, have seen their incomes stagnate or even fall. And that reflects the fact that these technologies don't affect everybody evenly.

So let's play this out. How do you see these technologies affecting work in the future?

Well, the technologies continue to advance, and they continue to affect different kinds of jobs. But what really matters is how we go about using them. What we've seen so far is that many of the technologies have been used to automate a lot of routine information-processing work, things like bank tellers, bookkeepers, a lot of middle managers. In fact, about 60% of Americans primarily do information-processing work, so that's a big category. And machines are very good at automating a lot of these, especially the more repetitive, routine information-processing tasks.

It turns out that the people who do those jobs are typically in the middle of the income distribution, and what they've seen is that as machines get better at those tasks, there's less demand for humans to do the identical tasks. Or if they do still have jobs, they have to compete with machines that are doing them more and more cheaply. And that his pushed down wages. It's led to fewer job opportunities in those categories.

At the same time, there's been growth in job opportunities at the other ends of the spectrum, what David Autor and other people call job polarization. At the high end, you get creative people or entrepreneurs are making, in some cases, more money than ever before. It's probably the best time in history. If you have some kind of special talent that could be replicated digitally, you might end up being a billionaire.

On the other hand, the other end of the spectrum has also seen some growth, and those are jobs that require a lot of dexterity or physical tasks or interpersonal skills, things that machines aren't very good at. The thing is, often those jobs don't pay very well. And just to be specific, those are the kinds of jobs like a waiter or a gardener or a janitor, those kinds of tasks.

So what is your advice, then, to workers facing this world of changing technology? What should they do in order to be able to prosper in this world?

Well, what you'd like to try to do is strengthen those areas where humans have an advantage over machines. You don't really want to be competing against machines. Ideally, you'd like to do things were machines can leverage your talents. Data scientists are more in demand than ever before, because machines have created an abundance of data, but they can't analyze it. They can't even ask the right questions themselves. You need humans to do that. And so if you have those kinds of skills, you're more valuable than ever. And Silicon Valley, and now companies throughout the country and the world, are greatly demanding those kinds of workers. And so there's a set of categories around that.

I mentioned earlier, if you have some kind of special talents or creativity, machines aren't very creative. People who can sing well or who can invent new businesses, as entrepreneurs, many kinds of scientists, artists, if you're a great writer or write books, those are things that are probably more valuable now than before.

Another big category that's gotten to be more valuable is-- I touched on it earlier-- is some of these interpersonal skills-- nurturing and caring. I don't think it would have been very motivating if, at the half time of the football games last weekend, the coach had been a robot coach. You need a human to do that. And that means that leadership, team work, those kinds of things. We still connect with other people a lot better, and we will for some time.

And I think all those skills, from the creative ones to the interpersonal, the teamwork, the nurturing skills, they can all be developed. And I would encourage people to work harder at developing those kinds of skills. Become a better salesperson, negotiator, nurturing, caring for people, nursing. Those are all things that I expect to grow, even as machines take care of more and more of the routine, repetitive kinds of tasks.

So that's great advice to the workforce. Let's talk a bit about the people who are designing these technologies. How can we encourage more technological design that complements work, that utilizes these skills, that thinks about ways to enhance them or to work with them to drive productivity and economic performance?

Well, I'm glad you asked that question, because most people don't even get as far as asking that question. I think there's a widespread assumption out there that technology just happens, and there's nothing you can do to shape the path of it. The reality is that you can encourage people to have technologies that create more inclusive innovation, that helps people more broadly, or that mostly focuses on substituting for people, for that matter.

And we, as a society and as individuals, can shape the direction of technology to quite a significant extent. One of the things we can do is change around our tax policy and our government policies. One of the oldest rules of economics is if you want less of something, you tax it. If you want more of something, you subsidize it. Right now, ironically, we are taxing work. If two entrepreneurs come up with a billion-dollar idea, and one of them involves employing lots of people and one of them doesn't, our current tax system will put more taxes on the one that employs more people, and that's probably not we want to do.

Conversely, we don't tax pollution, carbon, congestion, things that we'd like to see less of. So we could rejigger the tax system to tax the things that we don't want more, and then we'll have less of them, and lower the taxes, or even subsidize, work. And I think that would guide entrepreneurs to be more creative about inventing things that have less pollution and more widespread labor. The Earned Income Tax Credit is a good example, but too small. Could be expanded at that.

Another kind of thing we could do is just recognize reward and motivate people. One of the things that I've learned over the past few years is how much people can be motivated by having a prize and a goal in front of them. I've been watching the DARPA Robotics Challenge, the DARPA Grand Challenge that led to the driverless car. And I see my colleagues in engineering, grad students, professors working nights and weekends to solve this challenge that has been put in front of them. And many times, they do come around to making huge strides in that.

Why don't we try to reward and motivate business leaders and economists to reinvent the businesses and economy the same way that technologists have been reinventing the technology? And in fact, here at MIT, we're launching something called the Inclusive Innovation Competition, which is designed specifically to recognize those business models that use technology to create broad, shared prosperity. We call it shared prosperity for the many, not just the few. It's just getting launched, but we think this is going to be a good way to recognize and highlight people who have done that. I think that's a great idea, and I hope that it creates a lot of attention, and that we get lots of people really thinking along these ways, because I think it's the genius of people-- using technologies to address important problems that will help make progress.

Yeah, and we all have choices. We can shape the future in that direction. And why don't we encourage people who are doing it in a way that does create this shared prosperity?

So let me ask this final question, because it's obviously on everybody's mind. And that is, from time to time in history, as you know better than I, people have worried that technology is going to replace work, it's going to be the end of work, we're not going to have enough jobs. And that's an issue on people's mind today. How do you think about that problem, given all of the innovation that's going on and that could come down the road?

Well, down the road, I could certainly imagine technology creating kind of a Star Trek economy. And I don't think that's necessarily a bad thing if technology's able to take care of all of our basic needs for us. But the more immediate issue is not that technology is going to eliminate all the jobs, but the types of jobs that are affected. The reality is that technology's always been destroying jobs. It's always been creating jobs. But most importantly, it's been changing the mix.

And what we're seeing recently, as I touched on earlier, is that mix is changing in a way that a lot of people are being made worse off, and other people are being made much better off. And we want to try to shape the direction of the technology. We want to also give people the skills and education so they can adapt to the new kinds of jobs that are available. And if we do that, I think we're going to be able to have that kind of world of shared prosperity.

The technology will march on, and we shouldn't try to stop the technology. That's how we get that bigger pie, that growth that I mentioned. But we can direct it. In the earlier industrial revolutions, when the steam engine and other

technologies came along, we adapted our institutions. We invented mass public education, first at the primary level, and then later at the secondary level.

We invented social security and a whole bunch of other policies that helped smooth that transition to a new kind of work force and cushioned the people who otherwise would have been left behind. We're going to have to reinvent education again. And this time, we're going to have to do our best to shape the technology that is aligned with our values.

Ultimately, it's not what the technology does to us. Technology is a tool. It's always been a tool, whether it's a hammer or an enterprise resource planning system. We have more powerful tools now than we ever had before, and that means we have more power to shape the future than we ever did before. But it starts with understanding that we have that power, and aligning our actions with our values.

Well, Eric, I think that's a really important message, and one that I'm delighted that we can deliver in this class and in other settings where people can really make a difference. So thanks for joining us today.

It's a tremendous pleasure. Thanks a lot, Tom.