THE BROOKINGS INSTITUTION

BROOKINGS CAFETERIA PODCAST

AI WILL AFFECT BETTER-PAID WORKERS, BUT WILL IT DISPLACE THEM?

Washington, D.C.

Friday, December 20, 2019

PARTICIPANTS:

Host:

FRED DEWS
Managing Editor, Podcasts and Digital Projects
The Brookings Institution

Guests:

MARK MURO
Senior Fellow and Policy Director,
Metropolitan Policy Program
The Brookings Institution

OTTAWA SANDERS
Post-Doctoral Fellow, Foreign Policy
The Brookings Institution

* * * * *

P R O C E E D I N G S

MR. DEWS: Welcome to the Brookings Cafeteria, the podcast about ideas and the experts who have them. I'm Fred Dews.

In February of this year, I had the chance to interview Mark Muro about his research on how automation and AI are redefining work. Now he's back on the show to talk about his new research showing how artificial intelligence can most affect better-paid and better-educated workers.

Also on today's episode meet Ottawa Sanders, a new post-doctoral fellow in Foreign Policy, who focuses on artificial intelligence and nuclear weapons proliferation.

You can follow the Brookings podcast network on Twitter @policypodcasts to get information about and links to all of our shows, including Dollar and Sense, the Brookings trade podcast; the Current; and our Events podcast. If you like the show, please go to Apple Podcasts and leave us a review.

And now on with the interview. Mark, welcome back to the Brookings Cafeteria.

MR. MURO: Hey, Fred. Great to be here as always.

MR. DEWS: You were last on the program in February of this year to talk about your report on automation in artificial intelligence and how they are redefining work. And now you're here to talk about a new report, also with Jacob Whiton and Robert Maxim, which is a closer look at what kind of jobs are affected by AI specifically. So it's a nice way to start the year and end the year with this really

interesting research that you're doing.

Can you first define what artificial intelligence is as opposed to automation?

MR. MURO: AI is harder to define because in some ways it's more emergent, it's newer, it's changing faster, and it's not discrete or tangible or physical like a robot. And it's not as predictable and linear as software, which is all about the computer executing rules. These technologies operate differently, frequently can use large amounts of data to actually learn. More broadly, they are simulating what humans can do and what would be called intelligence. And it's a huge debate about when this becomes actual intelligence, but they are mimicking the ability to perceive, to predict, to problem-solve, to reason, to learn, and planning.

And then I want to say one thing. Our work on AI is a subset of the broader realm of automation that we looked at. And we have defined AI, for all intents and purposes, as machine learning, which is perhaps the most discrete, most established form of AI, and that is the form of AI that uses huge piles of data to discover patterns within that. So I just wanted to make clear that's what we're doing, to make this very big and challenging analytic issue more manageable by looking at one piece of it.

MR. DEWS: So it sounds vital to understanding this research approach, this framework that we not think about AI the same way we think about an assembly line robot that puts a rivet into the door there and then moves it down or some other kind of machine itself that performs some action repetitively. This is a lot more complex than that, a lot more nuanced than that.

MR. MURO: And that's a great point because all of these technologies have

been, I think, unfortunately, thrown together into one thing. And that's because many of the analytic efforts around automation in general have actually pulled together all of these things. They include robotics. Typically they include software. And they say they include AI. I think they probably don't fully include AI. And at any rate, the AI piece of the story gets swamped in the much more established and for now bigger realm of factory robotics, for instance, other kinds of robotics, and then the huge role of software.

So we're trying to pull out, let's now truly try to isolate and identify dynamics affecting AI alone. And that's relatively new. There haven't been that many efforts to do this. There's no accepted single way to do it. But we think it's really important that we understand the specific technology rather than lumping it in with a broad, too amorphous bundle of automation technology.

MR. DEWS: Well, Mark, what would you say is your and co-author's topline finding about artificial intelligence and its relationship to work?

MR. MURO: One is that it's distinct, building on what I was just saying, and it's distinct in a specific way. Robotics and our work show this above all has had huge implications and impacts in the factory world. I think what most people, their first impression or first thought about automation is about factory automation, which is robotics. And there we've seen the massive impacts on blue collar workers.

The other huge bundle that we've seen is the story of software, including an increasingly big office enterprise computing packages, whether it's Microsoft or Salesforce. These have had a largely impact on the low- and medium-skill workers

within the office context who are maintaining processes in the office.

Our work shows that AI has a different footprint. It's not that blue collar footprint only, though we see a lot of AI in factory and a lot of it will affect workers in the manufacturing sector. But at the same time, the broadest, biggest, and really newest recognition we made is that these technologies are going to especially affect those in the upper and upper middle aspects of the white collar labor market.

As you go above the 50th and 60th and 70th percentile of income, you see more, not less, automation exposure or involvement. So these are technologies that are going to be used by white collar workers, managers, relatively well-trained and well-educated and well-paid people.

So there's this bundle, there's AI in the factory, and then there's this white collar cast to AI. Very different profile.

MR. DEWS: Well, in reading your report, there's a long section on the new methodology that you and your co-authors employed to do this analysis, and I think that's really at the heart of why this analytical framework is so unique and it's a different methodological lens than looking at, say, factory automation. Can you walk us through what that methodology is?

MR. MURO: Well, first I want to call out our incredible partner on this work, Stanford Ph.D. student Michael Webb, who is an acknowledged expert on patenting and developed our patent-based approach here.

Now, this all comes out of need. It is unclear how to get at the occupations involved in AI. One way has typically been essentially expert study, expert

assessment, and ultimately subjective views of how particular technologies will impact particular workers. And that has been helpful to the field.

But we think the uncertainty goes up when you look at AI because it's such a young field. And we think there are, in general, problems with subjective assessment. And so we've relied on this method that very cleverly and elegantly, in Michael's development of this, matches the particular verb-noun pairings of words in AI patents, patents for AI technology. It matches them and seeks the occurrence of the same words in actual federal occupational descriptions. So it's seeking overlap of words.

It's the most literal kind of analysis and, in that sense, very objective about where there seems to be a match between what AI can do as defined by patents that are looking forward and projecting possible commercial use and occupational descriptions, which are descriptions of what workers do. And we find all kinds of overlaps and those overlaps are the basis of this work.

MR. DEWS: And there's a chart in your report on page 10 that compares some extracted verbs and characteristic nouns of artificial intelligence patents. Can you give an example or two from this chart so listeners can kind of get a concrete sense of the terminology?

MR. MURO: Yeah. You're homing in on what I find endlessly fascinating here. Let's just do a few words, then we'll say what they mean: recognize image, recognize face, predict performance, detect abnormality, determine similarity, generate recommendation.

So, in a way, we could talk about what AI is theoretically, but another way to look at it, which is Michael Webb's contribution, is to just look at what it does as defined by founders of companies and creators of IP who predict it. So these specific capabilities are really as good a definition of what AI does as I've ever seen. And I just find this list of verbs and nouns fascinating, but it also gives us a key to unlocking what occupations will be affected.

MR. DEWS: So an AI application or a technology that generates recommendations, you pair that with an occupation that also has as part of its job description to generate recommendations, you could then say that that job function is -- to some degree could be affected by AI because the technology is there on the path.

MR. MURO: Absolutely. So I use that example because it's essentially what we do when we follow Amazon Prime prompts to check out a movie that's made by maybe the same director as the one we just saw or Netflix's recommendation of a cool related program. So those matches point us at work that could be done by AI.

MR. DEWS: Let's move on then to some more specifically around what that work is and who may be affected and how they may be affected by AI. Mark, can you first kind of generally talk about where you see AI in the economy right now?

MR. MURO: Yeah, and our sort of maps, graphics, and hotspots suggest this. So first, it's in the factory. That's where these kinds of algorithms are detecting defects in product cycles that are controlling processes. They're identifying problems. They're doing things like that and supplementing the work of people in

the factory.

But it's also in this white collar workplace, often in consumer interaction, call response, automated services, consumer recommendations on Netflix. And that whole zone of activity seems to be highly involved in AI applications.

Optimization, prediction, wherever that's happening farther up the corporate occupational distribution, those are big things that are happening. We see a lot of these matches of verbs and nouns in occupations like marketing, sales, computer programming is an interesting one, personal finance management, medical applications. I think a lot of us have been hearing about new developments in radiology for a while, where AI can do as good or better a job of reading scans.

So those are the two zones, and then this very dramatic curve. When you're in that white collar world, the more the worker is paid up to the 90th percentile, the more they will be involved with AI, for better or worse. That's important to add.

MR. DEWS: Well, now you bring up occupational wages as one way to kind of slice the workforce in terms of how AI might affect it. What about some other characteristics of the workforce that you see, like educational attainment, the kinds of roles that people have within jobs, demographics, age, gender?

MR. MURO: Yeah, absolutely. So educational attainment right off really jumped out and here the results of our analysis are almost opposite our early work on automation. In automation, broadly writ, with that focus on robotics and software that I mentioned, you see a heavy tilt to the underrepresented and lower income, lower education groups. Think of young people working in their first job at

McDonald's, you know, which I think is now heavily moving into using kiosk ordering and other systems, or the factory world heavily hit.

This is different. The highest, most affected educational category is B.A. attainment. So these are better-educated workers who will be contending with these technologies.

Men much more than women now, and that's opposite from earlier. I think this has to do with the role men play in corporate structures. Men are more senior. They're earning more, they're better educated somewhat, and are going to be using these technologies more or more affected by them. Very different pattern here. And, you know, we could get into geography, as well.

So the map, the hotspots, it looked at first glance a lot like the manufacturing geography because manufacturing is going to be heavily involved. But then you start noticing a lot of big coastal cities are involved, as well as big cities. And I think this reflects two things: software and high tech is going to be heavily affected by AI, not as a product, but as a tool for use; and then big business centers.

So on the AI map, much looks the same with the Midwest and the heartland glowing red, but then places like Seattle, the Bay Area look highly exposed. And I think that's because those places have a lot of high-tech manufacturing, they have big tech industry, and then they have big companies. And clearly the corporate world is going to be suffused with these technologies.

MR. DEWS: You just used the term "exposed," which I think is a vital concept, also, for people trying to understand this analysis. And I want to couch it in

an old saw, and it relates to automation, and that's a robot's going to take my job, the literal idea that a robot is going to replace your job or your task.

In this report you're talking about occupational exposure to AI technologies. Can you talk about what you mean by "exposure?"

MR. MURO: The word "exposure" is important in this whole field and we've continued to use it. And it describes places where there is this match of capability that technology can do that is currently being done by a human. So in that sense, the word points to perhaps a threat, the possibility of the work being replaced.

I actually prefer the word and use the word more of "involvement." Because I want to keep open at this point the possibilities that these relationships with technology can be positive, can be supportive of work.

I mean, I should say our analysis does not make a normative call of where the relationship of AI with the work that is identified is either negative or positive, whether it's a substitution or a complementarity. So we're trying to be studiously neutral on that.

Our partner, Michael Webb, is a bit darker and sees more of these relationships as likely negative, looking at the precedent of factory robotics and enterprise software in the office. But strictly speaking, our analysis is one of involvement.

Now, we think involvement can mean positive or negative impacts, but it certainly is going to mean flux, change, and disruption. And I think we can count on that.

MR. DEWS: So what, if anything, looking ahead should we as a society be doing to prepare for these continued advances in artificial intelligence?

MR. MURO: Well, a lot more than we are. And I would note that this is of concern across the aisle and geographically. People in the Bay Area are nervous about this, but people in Indiana are nervous about this. So this is a cross-cutting anxiety that I think is going to be a feature of the next decade and maybe our politics I think will eventually get to talking about this.

But I've been arguing that these technologies don't necessarily dictate specific different responses to uncertainty. They dictate and make more urgent the needs to put in place the kind of responses that we need anyway all across the economy. And that's an inculcating and sharing a constant learning mindset.

This is going to change and up the ante on education, up the ante on skills. We need to get better at training and retraining workers, homing in on how humans can add value where the machines are going to be adding new capabilities.

And in that list of things I talked about of what AI does, many of those are fairly sophisticated activities that we have often carved out as our own. And the machines are going to be able to do much more and much more of these higher value prediction and strategy and shaping of decisions. It puts more pressure on us to think what the next contributions are, but we're going to absolutely have to get better, rethink what education is; get better at what we call adjustment, the ability of workers to get retrained and move to the next things. We may need wage insurance to help workers move from one thing to another.

And then it's inevitable that a lot of people are going to break down. They're going to really have breaks in their careers and work and we're going to need to help them both with social supports, but also further education and reeducation. We're seeing how automation is going to find its way into every portion of the labor market.

This could have been viewed as somebody else's problem. And I think one thing this work does is underscore that every portion of the labor market is going to be contending with automation in some form.

MR. DEWS: Well, it sounds like a whole of society approach. It's not just a specific federal policy that's going to address this. I'm thinking we're in a generation that's transitional, but the youngest generation, those who are still in elementary school and high school now, they're kind of natively part of the world where automation and AI is just there. And how are we preparing that generation to become adults in that world?

MR. MURO: Yeah. And that's going to give them in some ways some advantages. They will maybe have fewer rigidities or assumptions about how they should live and work that may free them up to move in new directions that are going to be challenged here. But it's absolutely true that no portion of the labor market is going to be immune, though, from contending with these technologies and needing to find how they will add value. And that's at every tier of society. In work we're going to have to be able to justify what we do and to home in on what humans can do that the machines can't.

MR. DEWS: Well, I hope machines can't host a podcast. (Laughter) Or do the research that you do.

MR. MURO: I think the latter might be toast fairly soon, but I think you'll last longer.

MR. DEWS: I hope so. Well, Mark, what's next for you and other researchers in this particular subject area?

MR. MURO: Well, really where we were just winding up is exactly where we want to take our work and I think many do. We need to understand better than what are the durable traits, what are the durable skills? What does make a human able to add value in an era of increasingly brilliant machines, right? So I think that's very much where a lot of the work is going to be heading. What are the durable jobs of 8 to 10 years from now, for instance?

And then once we know those, how do we reengineer basic education? How do we change the labor market, training systems in light of that?

MR. DEWS: And are you and Jacob and Robert and your colleagues in Metro continuing your collaboration with Michael Webb?

MR. MURO: We very much love Michael and hope to continue doing things. And we have some other ideas in mind, some other possibilities. So, yeah, absolutely.

MR. DEWS: Well, Mark, I look forward to learning more about that and I want to thank you for spending some time today talking about this issue.

MR. MURO: Great, thank you. But machines have not done away with the

podcast, so thank you.

MR. DEWS: Well, that's good news. The report is "What Jobs are Affected by AI: Better-Paid, Better-Educated Workers Face the Most Exposure." It's by Mark Muro, Jacob Whiton, and Robert Maxim of the Metropolitan Policy Program. You can find it on our website, brookings.edu.

And now meet Ottawa Sanders in our "Coffee Break."

MS. SANDERS: My name is Ottawa Sanders. I am a post-doctoral research fellow for the Foreign Policy Program at Brookings Institution.

I grew up in Baltimore, Maryland, on the east side. I lived there with my mother and my sister. And when I was in middle school I moved to Howard County, Maryland, where I stayed until I went off to college at the age of 18.

What inspired me to become a scholar is a really interesting question. So this will probably put me in the category of being a big geek, but when I was in high school, I had in my bedroom a full-sized framed poster of the periodic table of the elements. At the time I wanted to be a medical doctor and I was and remain fascinated by science, fascinated by knowledge. And I remember staring intensely at the small photo of Marie Curie after which the element curie is named. And I just remember thinking I want to be like her one day. I want to make these big discoveries.

So I went off to the University of Michigan to become a medical doctor and I barely made it out of inorganic chemistry and organic chemistry did not go well at all. So I dropped that major and instead majored in political science with the hope of

perhaps finding myself.

Well, along the way, I met J. David Singer, who was at the time a professor political science at the University of Michigan. And he really is, I think, one of the primary reasons why I do what I do. I've always liked science and what I learned from him was that you could have a more behavioralist approach to political science generally speaking by doing research in an empirical, systematic way using the scientific method, much like how we do research in the physical sciences. And being somewhat of a geek and enjoying science, enjoying the rigor of the research, I just was immediately drawn to it.

I took a seminar with him called War and the Environment and everything was going well. It was the middle of the semester. And he must have saw something in me because he looked at me dead in the face in the middle of the seminar and said you're going to study nuclear weapons proliferation. I thought to myself what is he talking about? (Laughter) I didn't really know what that meant. That was not on my mind.

I was a research assistant for him for a full year. And I went off and I pursued my graduate training. And I, at the time, was still interested in weapons proliferation. I knew it was an important topic, but it didn't quite click for me. It wasn't at that time personally meaningful.

I had a rather important ah-ha moment in the middle of a seminar in which I was teaching my students the details of the nuclear fuel cycle and uranium enrichment and the extraction of plutonium from the spent plutonium rods. And it

clicked. I said, ah, this is the weaponization of knowledge, the weaponization of science. And at the time I said this is what I'm supposed to do. This finally makes sense for me.

I think the question of the most important issue facing today is a bit challenging because there are many issues and I think that we are at an important tipping point for domestic political affairs, as well as international affairs. But if I had to boil it down to a single issue, I think that the erosion of trust and the erosion of a cooperative spirit within the international system is quite disturbing because it has very real implications for international peace and stability broadly defined here as the absence of armed conflict.

Consider, for example, the treaties and the agreements that make up the nonproliferation regime. Treaties and agreements exist because of trust and cooperation. One side has to trust that the other side will uphold the agreements and the stipulations of the treaty. And there needs to be a significant level of cooperation such that the parties can sit down at a table and amicably hash out disagreements in a way that is productive and in a way that sustains the agreement.

What we're finding in the instance of arms control is an erosion of trust and an erosion of the cooperative spirit as evidenced by the collapse of the Intermediate Range Nuclear Forces Treaty, which was an agreement made between the U.S. and the USSR, now Russia. The INF Treaty prohibits certain missiles with the range between 500 and 5,500 kilometers. And the concern is that the collapse of the INF will restart a nuclear arms race between the two countries.

In addition, the New Strategic Arms Reduction Treaty, also known as New START, is at risk of not being renewed. It is set to expire in February 2021. And the tensions between the U.S. and Russia are manifesting in this particular area because there is a concern by both sides and other policy analysts and policymakers that the treaty is not going to be renewed or not going to be replaced.

As a scholar at Brookings, I work very hard to think of ways in which I can apply my expertise in nuclear weapons proliferation to understand the weaponization of artificial intelligence. We will inevitably have a conversation as a nation about preventing the spread of AI weapons. We've done so in other instances of emerging technology, for example, nuclear weapons, of course, and biological and chemical weapons. And we will do so again for AI.

The question then that needs to be answered is how do we distinguish a military use AI program for a civilian or commercial AI program? That is not easy. The challenge is that while there is overlap between AI and nuclear weapons, I think at the core they are fundamentally distinct. AI is really a facilitating technology similar to electricity. And while it makes sense that AI systems can be incorporated into existing conventional or nuclear capabilities, you need not have an integration of AI into a piece of military hardware for AI to have an impact or an important addition to a state's military capabilities.

For example, AI can be used to enhance or augment decision-making, making it easier to make predictions that have very real consequences for the battlefield. But we're not talking about deploying a particular new weapon system

per se in that example. So while it is true that AI and nuclear weapons systems certainly overlap, I think that there are some rather significant fundamental differences between the two types of technology, which makes researching it a little bit more challenging, but also exciting.

Recommending a book to listeners is a fun question. I really enjoy fiction and I am particularly interested in the books that are written and published by the Japanese author Haruki Murakami. I'm currently reading a book written by him called *Kafka on the Shore*. And it is a delightful coming-of-age story about a young boy who leaves behind his family and his friends to go off and make some discoveries of his own. And Murakami is just a brilliant author that really knows how to kind of entangle our sense of reality with a sense of imagination and fantasy and play that makes it an exciting read.

However, if I could recommend one book I would recommend *The Power of Now* by Eckhart Tolle. Now, that's a little bit controversial perhaps because some people who have heard of it or who have read it might conclude that it's too new-agey. And there's certainly a new age and spiritual element to the book, but the message of the book is a simple one. It is to recognize and appreciate more the present moment, the here and the now.

And that is important because I think a lot of policy analysts, such as myself, spend a lot of time projecting ourselves into the future so as to try to arrange certain policies that will make for a better future. And that is obviously a laudable thing to do and it is a necessary thing to do. But to be reminded of the present moment and to

be grateful for things as they are right now, even though it might be challenging, really empowers us and gives us the motivation and the energy and the inspiration to create a better future.

MR. DEWS: The Brookings Cafeteria Podcast is the product of an amazing team of colleagues, starting with audio engineer Gaston Reboredo and producer Chris McKenna. Bill Finan, director of the Brookings Institution Press, does the book interviews, and Lisette Baylor and Eric Abalahin provide design and web support. Finally, my thanks to Camilo Ramirez and Emily Horne for their guidance and support.

The Brookings Cafeteria is brought to you by the Brookings Podcast Network, which also produces Dollar and Sense, The Current, and our Events podcasts. Email your questions and comments to me at bcp@brookings.edu. If you have a question for a scholar, include an audio file and I'll play it and the answer on the air.

Follow us on Twitter, @policypodcasts. You can listen to the Brookings Cafeteria in all the usual places. Visit us online at Brookings.edu.

Until next time, I'm Fred Dews.

* * * * *

CERTIFICATE OF NOTARY PUBLIC

I, Carleton J. Anderson, III do hereby certify that the forgoing electronic file when originally transmitted was reduced to text at my direction; that said transcript is a true record of the proceedings therein referenced; that I am neither counsel for, related to, nor employed by any of the parties to the action in which these proceedings were taken; and, furthermore, that I am neither a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of this action.

Carleton J. Anderson, III

(Signature and Seal on File)

Notary Public in and for the Commonwealth of Virginia

Commission No. 351998

Expires: November 30, 2020