

ADVANCES IN AI: ARE WE READY FOR A TECH REVOLUTION?

HEARING

BEFORE THE
SUBCOMMITTEE ON CYBERSECURITY, INFORMATION
TECHNOLOGY, AND GOVERNMENT INNOVATION
OF THE

COMMITTEE ON OVERSIGHT
AND ACCOUNTABILITY

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ADVANCES IN AI: ARE WE READY FOR A TECH REVOLUTION?

Wednesday, March 8, 2023

HOUSE OF REPRESENTATIVES
COMMITTEE ON OVERSIGHT AND ACCOUNTABILITY
SUBCOMMITTEE ON CYBERSECURITY, INFORMATION TECHNOLOGY,
AND GOVERNMENT INNOVATION

Washington, D.C.

The Subcommittee met, pursuant to notice, at 2:19 p.m., in room 2154, Rayburn House Office Building, Hon. Nancy Mace [Chairwoman of the Subcommittee] presiding.

Present: Representatives Mace, Timmons, Burchett, Greene, Luna, Edwards, Langworthy, Burlison, Connolly, Lynch, Khanna, Mfume, and Gomez.

Ms. MACE. All right. Good afternoon, everyone. The Subcommittee on Cybersecurity, Information Technology, and Government Innovation will come to order.

Welcome and good afternoon to everyone who is here on both sides of the aisle. Without objection, the Chair may declare a recess at any time. I recognize myself for the purpose of making an opening statement, if I may.

Thank you all for being here today, the time and the effort and commitment to this congressional hearing on our artificial intelligence. As Chair of this committee, I recognize myself for five minutes to provide an opening statement on this very important topic which many of us here today are extremely passionate about.

The field of artificial intelligence is rapidly evolving, and one of the most exciting developments in recent years has been the emergence of generative models. These models have shown the ability to produce human-like language and even generate images, videos, and music. While the potential applications of generative models are vast and impressive, there are also serious concerns about the ethical implications of their use.

As we explore the potential of AI and generative models, it is essential that we consider the impact they may have on society. We must work together to ensure that AI is developed and used in a way that is ethical, transparent, and beneficial to all of society. This will require collaboration between government, industry, and academia to ensure that the AI we develop is reliable, trustworthy, and aligned with public policy goals.

Moreover, we must consider the operational legal responsibilities of companies that use these models. AI can help us make better de-

cisions, but we must also ensure that those decisions are ethical, unbiased, and transparent. To achieve this, we need to establish guidelines for AI development and use. We need to establish a clear legal framework to hold companies accountable for the consequences of their AI systems.

The Federal Government has an important role to play in the development and deployment of AI. As the largest employer in the United States, the government can use AI to improve operations and provide better services to the public. AI can help reduce costs, improve efficiency, and enhance the accuracy of decision-making, for example. AI can be used to analyze vast amounts of data to identify patterns and make predictions which can help government agencies make more informed decisions.

As we move forward, we must also ensure that AI is used for the benefit of society as a whole. While AI has the potential to improve efficiency, increase productivity, and enhance the quality of life, it can also be used to automate jobs, invade privacy, and perpetuate inequality. We must also work together to ensure that AI is used in a way that benefits everyone, not just a privileged few.

In conclusion, the emergence of generative models represents a significant step forward in the development of artificial intelligence. However, with the progress comes responsibility. We must ensure that AI is developed and used in a way that is ethical, transparent, and beneficial to society, and the Federal Government has an important role in this effort.

I look forward to working with my colleagues on both sides of the aisle on this committee to ensure that the U.S. remains a leader in the development of AI technologies. Thank you for your time and attention.

Now before I yield back, I'd like to note that everything I just said in my opening statement was, you guessed it, written by ChatGPT in AI.

The advances that have been made just in the last few weeks and months have been radical, they've been amazing, and show the technology is rapidly evolving. Every single word up until this sentence was generated entirely by ChatGPT. And perhaps for the first time in a committee hearing—I know Jake Auchincloss said a statement on the floor a couple weeks ago, but I believe this is the first opening statement of a hearing generated by ChatGPT or other AI models.

I now yield to the distinguished Ranking Member, Mr. Connolly, for your opening statement.

Mr. CONNOLLY. Thank you, Madam Chairwoman. And let me first thank you for reaching out on a bipartisan basis to talk about this Subcommittee and our agenda. I really appreciate that, and I wish more committees and subcommittees operated that way. And I think we had fruitful conversation. We actually had a meeting with certain cyber officials of the executive branch while we were in Munich at the Security Conference. And, again, I just appreciate your approach, and hope we can collaborate and make music together over the next two years.

The Cybersecurity, Information Technology, and Government Innovation Subcommittee has dedicated its first hearing to examining advances in artificial intelligence and its revolutionary impact on

society. This decision reflects our membership's interest in commitment of exploring, understanding, and implementing emergent technologies.

Last Congress, Chairwoman Nancy Mace, Representative Ro Khanna, and I introduced the Quantum Computing and Cybersecurity Preparedness Act, which encourages Federal agencies to adopt post-quantum cryptography. I'm also pleased the bill was signed into law just a few months ago. I look forward to future bipartisan collaboration as we define the problem sets associated with AI design solutions and that promote innovation while simultaneously mitigating the dangers and risks inherent in AI technology.

The Federal Government has a historic, necessary, and appropriate role guiding and investing research development for new and emerging technologies. The Defense Advanced Research Projects Agency, DARPA, the well-known research and development agency of the United States Department of Defense, is responsible for the development of myriad emerging technologies.

One of the most famous successes includes the ARPANET, which eventually evolved into the internet which we know today. Other innovations include microelectronics, global positioning systems, infrared—inferred night imaging, unmanned vehicles, and what eventually became cloud technology.

AI will require similar Federal investment and engagement. As stated in the January 2023 final report from the National Artificial Intelligence Research Task Force, the recent CHIPS and Science Act reinforces the importance of democratizing access to a national AI research cyber infrastructure. U.S. talent and frontier science and engineering, including AI, in the report calls for 2.6 billion over the next six years for the purpose of funding national AI research infrastructure.

While government certainly plays a role in R&D, a very important role, it also has a regulatory role. Congress has the responsibility to posture careful and thoughtful discussions to balance the benefits of innovation with the potential risks of emerging technology.

A recent National Bureau of Economic Research report found that AI could save the United States healthcare industry more than \$360 billion a year and be used as a powerful tool to detect health risks. A GAO report predicts AI could help identify and patch vulnerabilities and defend against cyber attacks, automate arduous tasks, and expand jobs within the industry.

As with all technologies, in the wrong hands, AI could be used to hack financial data, steal national intelligence, and create deep fakes, blurring people's abilities to certify reality, and sow further distress within our democracy. AI can cause unintentional harms. GAO found that certain groups, such as workers with no college education, tended to hold jobs susceptible to automation and eventually unemployment.

Another concern relates to machine learning and data. ML, machine learning, uses data samples to learn and recognize patterns, such as scanning hundreds or thousands of pictures of lungs to better understand pulmonary fibrosis and revolutionize medical care. But what happens if those lung samples only come from a homogeneous portion of the population? And that medical breakthrough

is inaccurately applied. When it comes to data, equity is accuracy and must ensure datasets include as much and as comprehensive a universe of data as possible.

It is paramount that during this hearing we begin to create a flexible and robust framework, particularly for government's use of AI to protect democratic values and preemptively address social, economic, and moral dilemmas AI might raise.

During the last Congress, this committee voted to pass the AI Training Act and the AI in Counterterrorism Oversight Enhancement Act, with bipartisan support. The committee is not entirely new to the AI space, and we look forward to continuing efforts to support transformative research. We also look forward to building on the Biden Administration's efforts such as the National Artificial Intelligence Resource Task Force. Just over a month ago, that task force released its report, providing a roadmap to stand up a national research infrastructure that would broaden access to the resources essential to AI.

AI is already integrated within the world around us, and its growing use throughout society will continue to drive advancements. America must implement an aggressive, research-forward Federal AI policy to spur competition with other countries that have already established nationwide strategies, and additional supporting policy strategies might also include promoting open data, policies, or outcome-based strategies when assessing algorithms.

Finally, and more importantly, our country needs the work force to properly develop, test, understand, and deploy AI. This work force of the future will include technologists who will help govern AI responsibly.

I look forward to hearing from our witnesses today. I look forward to collaborating with you, Madam Chairwoman, on any subsequent legislation we might want to develop.

I yield back.

Ms. MACE. Thank you, Congressman Connolly. And I, too, agree, I hope and I believe we will make music together, continue to do that. Cybersecurity has been one of the few places in Congress where we have been able to be bipartisan and not crazy. And so, I appreciate the ability to work with folks on both sides of the aisle.

I'm pleased to introduce our four witnesses today for this Subcommittee's inaugural hearing of the 118th Congress. Our first witness is Dr. Eric Schmidt, Chair of the Special Competitive Studies Project. Dr. Schmidt is a former Google executive, where he held multiple senior-level positions, working alongside founders Sergey Brin and Larry Page.

Google literally changed the world, and it's a huge honor to have one of the godfathers of modern day technology here with us today talking about the advent of AI and what comes next, because I believe this will be one of the greatest technological revolutions of our lifetime and around the world.

Dr. Schmidt is an accomplished technologist, entrepreneur, and philanthropist. Dr. Schmidt founded SCSP in 2021. This is a bipartisan, nonprofit initiative that works on issues relating to AI and other emerging technologies. Dr. Schmidt also co-authored a book in 2021 with Dr. Henry Kissinger and MIT dean, Dr. Daniel Huttenlocher, titled, "The Age of AI: And Our Human Future." The

book attempts to explain artificial intelligence while raising thought-provoking questions about the role of AI in topics such as security and world order. And there is a Wall Street Journal article that was an excerpt from the book that folks should pick up and read, “ChatGPT Heralds an Intellectual Revolution.” I’m going to encourage folks in this space to read it.

Our second witness is Dr. Aleksander Mądry, director of the MIT Center for Deployable Machine Learning. Dr. Mądry is also a member of the MIT Computer Science and Artificial Intelligence Laboratory, Cadence Design Systems professor of computing, and co-lead of the MIT AI Policy Forum. Dr. Mądry’s research interests span algorithms, continuous optimization, the science of deep learning, and developing reliable, trustworthy, and secure machine learning systems.

We look forward to hearing from you about the policy challenges and moral and ethical questions surrounding AI.

Our third witness is Dr. Scott Crowder, vice president of Quantum Computing and IBM, and chief technology officer, IBM Systems, Technical Strategy and Transformation. Dr. Crowder’s responsibilities include leading the commercialization effort for quantum computers and accelerating innovation within development through special projects.

The Subcommittee is very interested in learning more about quantum AI and how quantum computing may some day change the way AI models can store, process, and even report data.

Our fourth witness is Ms. Merve Hickok, Chair and research director for the Center for AI and Digital Policy.

We welcome everyone who is here today, and we are so pleased to have all of you here this afternoon.

Pursuant to committee rule 9(g), the witnesses, if you will please, stand up and raise your right hands.

Do you solemnly swear or affirm that the testimony you are about to give is the truth, the whole truth, and nothing but the truth, so help you God?

Let the record show that the witnesses all answered in the affirmative.

Thank you, and you may be seated.

We appreciate all of you being here today and look forward to your testimony. I want to remind the witnesses that we have read your written statements, and they will appear in full in the hearing record. Please limit your oral arguments to five minutes, initially. As a reminder, please press the button on the microphone in front of you so we can all hear you when you are speaking.

When you speak—begin to speak, the light in front of you will turn green. And after four minutes, the light will turn yellow. And then the light—red light comes on after your five minutes has expired. And we would ask that you please try to wrap up your comments at that time so that all the Members who are here today as part of this Subcommittee will get a chance to speak and ask you all questions.

I would like to first recognize our first witness, Dr. Schmidt, to please begin your testimony.

**STATEMENT OF DR. ERIC SCHMIDT, CHAIR
SPECIAL COMPETITIVE STUDIES PROJECT**

Mr. SCHMIDT. Chairwoman and Ranking Member, thank you so much, all of you, for spending some time on this incredibly important issue.

I've been doing this for 50 years, and I have never seen something happen as fast as this round. It took five days for ChatGPT to get to a million users, and now we have it being used here in Congress. And, if you look throughout the country, throughout America, throughout the world I live in, machine learning in the broad form has taken it by storm. I'm used to hype cycles, but this one is real in the sense that enormous amounts of money are being raised to implement and build these systems.

The sense to me is that this moment is a clear demarcation: A before and an after. And in our book, "Age of AI," which you kindly mentioned, we actually talk about this is actually more than just an industrial strategy, it is actually a new epic in human experience. The last epic, of course, was the age of reason 400 years ago which came from the century of the printing press and the Reformation and things like that.

The ability to have nonhuman intelligences that we work with and occasionally have to deal with is a major change in human history and not one that we will go back to. And you can imagine, if you speculate 10, 20, 30 years from now, at the rate at which this innovation is going, what it would be like to having these nonhuman intelligences in the midst, right? A topic for another day.

The two most interesting things that have emerged in the last year have been large language models. Large language models can be understood as a system that was originally built to predict the next word, the next sentence, the next paragraph. But if you make them big enough—and when I say big, I mean huge—to the cost of a hundred million dollars, 200 million to build them, they appear to have emergent properties. They have what is technically known as capability overhang. In other words, we don't know exactly what they know. Although we do know they know an awful lot of things that are wrong, but we also know that they have a lot of insights.

This has spurred enormous industry and a set of competitors that will be emerging in the next month or two. It's literally that fast. So, boom, boom, boom.

The other one is the term "generative AI," which for me is largely focused on the ability to generate new language, new pictures, new videos, and so forth. It's reasonable to expect that, in the next few years, a great deal of the content that we consume will be generated for us.

Now, these are very, very, very powerful technologies. And the impact on society is going to be profound, and I don't think any of us understand how broad and how deep it will go.

When I look at some of the issues that you all should face, I think the most obvious one is, what do you do about how people interact with the platforms? And I'll offer three principles.

One is the platforms need to know where the content came from and they need to be able to tell you—this is to avoid misinformation, Russian actors, that sort of thing. You need to know who the

users are. Even if you don't tell the end user who they are, there needs to be some notion of who they are and where they came from. True anonymity hidden behind a paywall would allow nation-state attacks. And the third is that these systems have to publish how their algorithms work, and then they have to be held to how their algorithms work. Those simple principles, I think, will help us manage the extreme cases here.

We all, everyone in this room, wants the U.S. to win in this. And, again, Ranking Member, you mentioned—Connolly, you mentioned this issue around the national resource. My colleague to the left can speak about what it's like to be in a university where you don't have access to these models. We need that, and we need the computing capability as it transforms, not just language, but also every aspect of science and health and biology and material science.

We want democratic partners, that is other countries. This is something where the West can do this together, and we can beat China, who is my primary focus. And, obviously, we need more AI and software talent in the government. And we wrote a long report for you all called the NSCAI that goes into that in great detail.

What I want you to do is imagine the alternative. China announced a couple of years ago that they are going to be the dominant force in AI in 2030. Can you imagine the technology that imbues how we think, how we teach, how we entertain, and how we interact with each other imbued with Chinese values, not American values, not the values and rules that we have in our democracy? It's chilling.

The military consequences are also profound, as are the biological, which we can talk about if you're interested. But the most important thing to understand is that we need to win because we want America to win, and this is our best, great opportunity to create trillions of dollars of wealth for American firms and American partners.

Thank you.

Ms. MACE. Thank you, Dr. Schmidt.

I would now like to recognize our second witness, Dr. Mađry, for his opening statement.

STATEMENT OF DR. ALEKSANDER MADRY, DIRECTOR, MIT CENTER FOR DEPLOYABLE MACHINE LEARNING, AND CADENCE DESIGN SYSTEMS PROFESSOR OF COMPUTING, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Mr. MAĐRY. Chairwoman Mace, Ranking Member Connolly, Members of the committee, thank you for inviting me to testify.

Today, I want to make three points: First, AI is no longer a matter of science fiction, nor is confined to research labs. The genie is out of the bottle. AI is being deployed, broadly adopted, as we speak.

The key factor that made recent AI tools so popular is the accessibility. Tools like ChatGPT can be directed using simple language commands. We can ask it to draft us a memo or a speech or summarize a movie in much the same way we would ask any human. No AI expertise required.

As the barrier to adopting AI gets lower and lower, AI will spread across our economy and our society. It will assist us in men-

tal and creative tasks, such as writing, visual design, and coding. It will bolster and expand our capabilities. It can even help us integrate our accumulative knowledge; for example, in healthcare, in science, and engineering.

But along with these opportunities, AI also brings risks. OK. Its lack of reliability; its propensity for promoting bias and enhancing social inequities; its undermining of accountability; its facilitation of deep fakes and manipulated media; its ability to fuel personalized, online phishing and harassment at scale.

It's critical we proactively identify these emerging risks and develop clear and actionable ways to mitigate them. While doing that, we need to recognize, though, all the positives of AI and balance them against the negatives. In the end, the impact of AI is not a foregone conclusion as much as rapid progress of AI might suggest otherwise.

This brings me to my second point. As we engage with AI more directly, we expose ourselves to interactions that go against our intuition. Because AI exploits our cognitive biases, we are often too likely to accept its results as gospel. Indeed, as we are able to communicate with AI so easily, so seamlessly, it's natural for us to think of them as human, but this is a mistake. These tools aren't human. They're a simple computation executed at impressive scale.

By creating—by treating them as human, we fool ourselves into thinking that we understand how AI tools behave. We fool ourselves into thinking that we can straightforwardly adapt policies designed for humans to work in AI-driven contexts.

Indeed, our intuition often fails us. Take ChatGPT. Given a question, it can write a really convincing answer, even if everything it is writing is factually incorrect. It can trick us into thinking the answer is critical by using prose that sounds like human experts. Therefore, an unmitigated reliance on such tools in our day-to-day lives, or even worse in our education, can have disastrous consequences. It can erode our analytical and reasoning capabilities.

The final point I want to make is that we also need to pay attention to how AI is deployed. That is, if we focus solely on what I have discussed so far, we'll have a major blindspot. A key feature of measuring AI systems is that they can be used as foundation on top of which other systems are being built, forming what I would call AI supply chain.

The upstream of this chain are organizations that create the foundation AI tools, like ChatGPT. And here, very few players will be able to compete, given the highly specialized skills and enormous capital investments the building of such systems requires. In contrast, we should expect an almost Cambrian explosion of startups and new use cases downstream of the supply chain, all leveraging the capabilities of upstream AI systems.

This leads to a couple of policy-relevant observations. First, the limited number of large upstream systems may introduce new challenges, such as hidden systemic fragilities or structural biases. Imagine, for instance, if one of these upstream models goes suddenly offline. What happens downstream?

Second, AI system won't be developed by a single entity. They will be products of multiple AI systems grouped together each from a different place. These composite systems will become even harder

to predict, harder to audit, harder to regulate. For instance, who will be responsible and legally liable when something goes wrong?

Third, this AI supply chain can redistribute power, control over where, when, and how AI is used. This factor will be paramount from a societal standpoint, from a geopolitical standpoint, from a national security standpoint.

To conclude, let me say, we are at an inflection point in terms of what future AI will bring. Seizing this opportunity means discussing the role of AI, what exactly we want it to do for us, and how to ensure it benefits at all. This will be a difficult conversation, but we do need to have it and have it now.

Thank you for the opportunity to speak with the Subcommittee. I look forward to the questions.

Ms. MACE. Thank you.

And I would like to recognize our third witness, Dr. Crowder, for your opening statement.

STATEMENT OF DR. SCOTT CROWDER, VICE PRESIDENT, IBM QUANTUM, AND CTO, IBM SYSTEMS, TECHNICAL STRATEGY AND TRANSFORMATION, IBM

Mr. CROWDER. Chairwoman Mace, Ranking Member Connolly, and distinguished Members of the Subcommittee, thank you for this opportunity to testify before you today.

Today, I represent IBM Quantum where we have two goals: to bring usable quantum computing to industry and research and to make our digital infrastructure quantum safe. We have a network of over 200 industry and research partners exploring the use of quantum computing for business and science, and have developed technology to make the transition to quantum safe cryptography easier.

There is a common perception that classical computers can solve any problem if they're just big enough. That is not the case. There is a whole class of problems that classical computers are not good at and never really will be.

When I talk to leading U.S. companies about their unsolved problems that if solved could bring them huge economic benefit—these types of problems turn up everywhere. Some of these longstanding problems could be solved with a combination of quantum computing and artificial intelligence.

Quantum computing is a rapidly advancing and radically different computing paradigm which could launch a new age of human discovery. Just seven years ago, the notion of a quantum developer didn't exist. IBM was the first to put a real quantum computer on the cloud; at the time it was just five qubits. Today, IBM has systems over 400 qubits. And if we continue on this technology roadmap, by the middle of this decade, we'll have 4,000 qubit systems and will demonstrate the first practical use of quantum computing.

IBM alone has deployed over 60 systems, and our 500,000 registered users have published over 2,000 research papers. One key thread in this research is the application of quantum computation within artificial intelligence. Many of our partners have published research results using quantum machine learning techniques. Examples include financial institutions exploring quantum algorithms

for improved fraud detection; Boeing exploring optimization of composite materials for better airplane wings; and CERN exploring applications in high-energy physics.

One primary reason quantum computing has benefit for artificial intelligence is because it uses a different method to find patterns in data. For example, in fraud detection, a quantum algorithm may be better at detecting true fraud and reducing false positives. A data scientist may choose to use either a quantum fraud model or a classical AI fraud model or a combination for the best results. Put simply, quantum will be another computational tool to use to improve AI results.

Generally, we see the future of computing as a combination of classical, specialized AI, and quantum computing resources. It will not be based solely on classical bits, but rather built upon bits and neurons and quantum bits, or qubits. This will enable the next generation of intelligent, mission-critical systems and accelerate the rate of science-driven discovery. Researchers, companies, and governments that leverage this technology will have a distinct competitive advantage.

That leads to a critical point: When one examines the financial commitment other countries are making in quantum computing, our belief is the U.S. Government investment in driving this critical technology is insufficient to stay competitive. At its inception in 2018, the \$1.7 billion National Quantum Initiative stood as a leading public investment. Today, the planned global public investment in quantum technology is estimated to exceed \$30 billion, with China at \$15 billion. It is critical that we not only reauthorize the NQI, but also increase its investment in the critical area of research of use of quantum computers for mission-critical applications.

The same importance for ethical and trustworthy AI applies whether classical compute or quantum compute underpins the solution. We know that trustworthiness is key to AI adoption, and the first step in promoting trust is effective risk management policies and practices. Companies must have strong internal governance processes, including, among other things, designating a lead AI ethics official responsible for its trustworthy AI strategy, and standing up an AI ethics board as a centralized clearinghouse for resources to help guide that strategy. IBM has implemented both, and we continue to advocate others in the industry to do likewise.

Additionally, it's important to establish best practices for AI bias mitigation, similar to BSA's framework published in 2021.

It's difficult to pinpoint the precise benefits and possible challenges presented by any new emerging technology. Quantum computing is no different. However, those countries that make investments in this transformative technology today will reap benefits in the years to come. Those countries that do not will be at a competitive disadvantage in the future. At the same time, countries will also need to invest time and energy in developing an appropriate regulatory environment that supports the adoption of trustworthy AI regardless of the underlying compute technology.

Thank you again for inviting me to testify, and I look forward to today's discussion.

Ms. MACE. Thank you.

And I would like to recognize our fourth witness, Ms. Hickok, for your opening statement.

STATEMENT OF MS. MERVE HICKOK, CHAIR AND RESEARCH DIRECTOR, CENTER FOR AI AND DIGITAL POLICY

Ms. HICKOK. Thank you so much.

Good afternoon, Chairwoman Mace and distinguished Members of the committee. I'm Merve Hickok, Chair and research director for Center for AI and Digital Policy. It's an honor to be here today, and thank you for the opportunity to testify.

CAIDP is a global research organization based in D.C. We educate and train future AI policy leaders, collaborate with AI policy experts around the world. We also publish AI and Democratic Values index, analyzing AI policies and practices across 75 countries.

I also train and build capacity in organizations on responsible AI development and governance. And prior to CAIDP, I was in the corporate world as a senior leader at Bank of America Merrill Lynch, responsible for recruitment technologies internationally.

I provide this background because we believe in the promise of AI. However, we also know that AI systems, if not developed and governed with safeguards, have negative impacts on individuals and society. We believe that AI should first and foremost serve members of the society, their rights, their freedoms; our social, moral, and ethical values.

The title of the hearing today asks if you are ready for a tech revolution. My brief answer is no. We don't have the guardrails in place, the laws that we need, the public education, or the expertise in the government to manage the consequences of the rapid technological changes.

Internationally, we are losing AI post leadership. Domestically, Americans say they are more concerned about—concerned than excited by AI making important life decisions about them, knowing their behavior. AI systems now produce results we cannot assess or replicate. Opaque systems put governments, companies, and individuals at risk. AI expands our research and innovation capabilities; however, it also replicates existing biases in the datasets and biases in the choices of the developers, resulting in disadvantaging people with disabilities in hiring, for example; inaccurate health predictions for patients of color; offering women lower credit, lower home valuations; innocent people being arrested due to biased facial recognition.

We are now debating generative systems which produce synthetic text, image, video, and audio. The systems will certainly add to our creativity, there is no doubt about it, but they're already impacting the original creators. They will also be used by malicious actors to fabricate events, people, speeches, and news for disinformation, cyber fraud, blackmailing, and propaganda purposes.

I give this testimony on International Women's Day, when unregulated opaque AI systems deepen discrimination and online harassment against women.

Both governments and private companies know that public trust is a must-have for further innovation, investment, adoption, and expansion. Companies, large and small, are calling for regulatory guidance.

Administrations of both parties have called for trust for the AI. President Trump's Executive Order 13960 explained that ongoing adoption and acceptance of AI will depend significantly on public trust, and AI should be worthy of people's trust, and that this order signals to the world U.S. commitment to develop and use AI underpinned by democratic values. The order characterized trustworthy AI as being lawful, respectful of civil rights, accurate, reliable, safe, understandable, responsible, transparent, accountable, and regularly monitored.

Office of Science and Technology has recently published AI—Blueprint for an AI Bill of Rights, a critical policy framework underscoring similar qualities for AI, emphasizing democratic values and civil rights.

President Biden has called for bipartisan legislation to keep companies accountable, and reiterated the same principles: transparency, accountability, and safeguarding our values.

We very much support this committee and its bipartisan nature, but there are real challenges ahead, and I will conclude with a few recommendations toward those.

We really need the Congress to hold more hearings like this, explore the challenges, the risks and benefits, and hear from the public and those impacted. We need the Office of Management and Budget to move forward with the long-delayed rulemaking for the use of AI in Federal agencies as part of the executive order. We need to build multidisciplinary capacity in Federal Government to ensure the work force understands the benefits and risks of AI. We need the wider work force to understand benefits and risks of AI as well. We need R&D capabilities expanded beyond a handful of companies, campuses, and labs, and demand trustworthy AI with our research agenda. I urge you to act now to enact the legislation reflecting the bipartisan nature.

Absent a legislative agenda or implementation of AI policy, American people, American companies, and allies are lost about U.S. AI policy objectives.

Thank you.

Ms. MACE. And thank you.

And I think one of the things that sticks out to me today is, actually, this is the first AI hearing this Congress in the U.S. House of Representatives. But also, this same day, the U.S. Senate had their first hearing on AI on this subject matter; they beat us by four hours this morning at 10 a.m.

But I would now like to recognize myself for five minutes for a few questions of our panelists.

Thank you, Dr. Schmidt, for painting what I would describe as a very vivid picture of what is happening in this space, because I agree with you, it's been rapid and, in your words, epic. And I'm not sure that the world is ready for what is to come in the next few months, years, et cetera. And so, it reminds me of Einstein. He said: "I never think of the future. It comes soon enough." And it is here. And it is moving faster than the speed of light.

So, my first question today is for Dr. Schmidt. How can we ensure that AI technology is developed in a way that is safe, transparent, and beneficial for society without stifling innovation?

Mr. SCHMIDT. I'm always worried about AI conversations, because everyone believes the AI that we are building is what they see in the Terminator movies. And we are precisely not working on those things. So we are clear, we are not doing——

Ms. MACE. Not yet.

Mr. SCHMIDT. We are not doing it yet, and we are not likely to. But what we are doing is working on systems that will affect the way people perceive their world. And I think the best thing for America to do is to follow American values, which include robust competition with government funding of basic research, and using the innovators, including the folks to my left, to actually deliver on this.

I think that one of the things that is not appreciated in the last 30 or 40 years of tech companies is—speaking as a person who is associated with a number of them—is how good they are as American exports of our values. So, I come back to a much simpler formulation that American ingenuity, American scientists, the American government, and American corporations invent this future and will get something pretty close to what we want. And then you guys can work on the edges where you have misuse.

The alternative is, think about if it comes from somewhere else which doesn't have our values. And I really believe that. Everything that you can do to finish, to support that innovation cycle, the universities, the graduate students, getting foreigners who are high-skilled in to help us, building those corporations, creating shareholder wealth, hiring lots of people—it's the American formula, and it will work here too.

Ms. MACE. And then, on that note, in terms of the personnel, the resources, training folks in the technology so that it can advance, having that innovation. And lot of it is on the software side, but how does hardware figure into that? CHIPS, for example.

Mr. SCHMIDT. So, in our AI commission that you all commissioned a while ago, we spent a lot of time on this. We felt it was very important for America to retain its leadership, which of course we didn't have, we gave it to Taiwan. The best result was to basically get the Taiwanese firms, primarily TSMC, and Korean firms, primarily Samsung, to locate plants in the United States, which has occurred.

The Trump and Biden administrations have done a good job of restricting some of the sales and access to these tools to the Chinese. But, fundamentally, this is a race, it's a competition, and we're not that far ahead. So, we have to keep innovating, which is why your support for the CHIPS Act was so helpful. And so, on behalf of the whole industry I'll thank all of you for doing that. That's a good example of the government getting ahead of a real problem.

Ms. MACE. Thank you.

And, Dr. MaDry, my next question for you, do we need to be worried about too much advancement too fast in AI? Are we capable of developing AI that could pose a danger to humanity's existence all over the world, some of the things that people talk about out of fear in this conversation because of a lack of knowledge, or is that just science fiction?

Mr. MADRY. Well, it really depends on what do we view as this kind of catastrophic risk. So, a Terminator-style scenario, I'm not

too worried about this, as Dr. Schmidt just said. What I am worried is about something more mundane but essentially very, very corrosive, right. So, we see how this works out in social media where, essentially, AI also runs in social media. That's what decides what we see. And we are seeing the effect of that. Well, this is kind of not really transparent, not really aligned with the societal goal.

So, that is—now think about things like this new generative models developed essentially in a way when we just maximize the profit, we just try to get maximum adoption. I'm worried about that.

Having said that, I do think we can figure it out how to not stifle innovation, just moderate it so we still can progress. But just, again, ensure that the companies that we talk to, they are not only—only driven by profit, but realize they have some responsibilities, and they need to acknowledge them.

Ms. MACE. And I would agree. And I think, you know, we've talked about algorithms for years, like on social media, and the use of divisiveness of politics today, and each side getting the extreme of their side and getting fed more of that information. I sort of feel like it would be—we were putting it on steroids of the future, immediate future of what the advances in AI might be. What are your concerns there?

Mr. MADRY. Yes. So, essentially, I think saying that this might be like social media on steroids is very much—is very much justified. So, again, now I told you that ChatGPT will be so much more pervasive than social media. And, essentially, we don't exactly know what will be the effects on our thinking here or like the way our children learn to think. Like, do they just fully trust what ChatGPT tells them or do they learn how to reason?

So, again, I'm really worried about this, but I think—and that is where the government really needs to step up. We can—you know, with enough involvement with government, which I think might not be too much in context of social media, but here we have to do it differently, and I think that we will do it well.

Ms. MACE. Thank you.

I would now like to recognize my esteemed colleague, Mr. Connolly, for questions.

Mr. CONNOLLY. Thank you so much, Madam Chairwoman.

Listening to Ms. Hickok and the potential of AI is actually really positive in terms of how it can complement the quality of life for humans and make things better and promote peace and harmony. But we know that technology can be used for good and evil.

And I'm listening to what you just said, Dr. Madry, in terms of your hope for the government's role. And yet, if you look at social media and you look at technology in general, Congress has been very reluctant to get into the game of regulation. And as a result, awesome power has been developed by and deployed by entrepreneurs who became billionaires in, largely, Silicone Valley without any interference by the government. They make all kinds of massive decisions in terms of content, in terms of what will or won't be allowed, in terms of who gets to use it, et cetera.

And so, why should we believe that AI would be much different in terms of its future in the hands of the Federal Government?

Mr. MADRY. Well, again, the hope here is that we will—don't play the same playbook we played for social media. And in particular, I think the point of start here is before we go—so, first of all, I want to say that I strongly believe that regulation is a very important tool to make sure that, you know, just certain technologies are aligned with like broad societal benefits, and they need to be used.

Having said that, before we go to premature regulation and we kind of rush regulation, first of all, even the rush regulation might not be fast enough for AI because AI is a very fast moving target. But even we forget, I think what we need to start, we need to start ask questions. And, in particular, government needs to ask questions of this company saying, what are you doing? Why are you doing this? What are the objectives of the algorithms that you are developing? Why is there no objectives? How will we know that you are accomplishing these objectives? How can we have some input into what these objectives showed.

I think this change of tone, together with the government recognizing that you cannot abdicate AI to the big tech, as capable as they are, that they have different use cases. They have different priorities. Like, that's what needs to change. If this doesn't change, I'm extremely worried.

Mr. CONNOLLY. Well, I just think, if we look at the past and we look at social media, I wouldn't bet the farm on any kind of rapid regulatory regime coming from the Federal Government.

Mr. MADRY. And just to clarify, that's what I—that's exactly what I'm worried about. So, let's have conversations we can have now.

Mr. CONNOLLY. Right.

Mr. MADRY. Hopefully, we'll learn from the mistakes.

Mr. CONNOLLY. Thank you.

Dr. Schmidt, you want to see the United States get ahead in this lane of technology and to compete successfully against the Chinese. Can you talk a little bit about what is the nature of that threat? How well are they doing in this sphere, and what do we need to be concerned about?

Mr. SCHMIDT. There are four or five companies, Mr. Leader, that are American or British firms that have extremely large language models. There's also at least one large one in Baidu in China. I was interested to note that the largest noncorporate such example in the world that is not owned by a corporation is also in Tsinghua University in Beijing.

So, there's every reason to believe that the Chinese understand everything that we're talking about now extremely well. They've published their intent, so we can read about it. And I view it as a national emergency. This technology is so powerful in terms of its ability to transform science, innovation, biology, semiconductors, you name it—and along with quantum, I should add—that we need to get our act together to win and to win a competition.

If we don't—let me give you some examples. AI can be used to generate good things in biology, but also lots of bad viruses. You all have created a Bioterror Commission, which I'm fortunate to serve on, to take a look at this and the impact of that. That's another example of national security.

The issues of misinformation of the nation-state could be very significant. Think about the progress of war and conflict where decision-making can be done faster than the OODA loop or faster than human decision-making. These are all challenges, and our government is behind where it needs to be in the adoption of these technologies for national security as well.

Mr. CONNOLLY. I just would end by saying, I couldn't agree with you more. And I think really we need to be looking at sort of like, you know, the race to the moon kind of shot in, you know, quantum computing, AI, cyber, 5G. Because if the Chinese dominate those areas, the future is theirs.

I yield back. Thank you, Madam Chair.

Ms. MACE. Thank you, Mr. Connolly.

I would now like to recognize a fellow South Carolinian, Congressman Timmons.

Mr. TIMMONS. Thank you, Madam Chair. That's great to say: Madam Chairwoman. Congratulations on being the Chair.

Ms. MACE. Thank you.

Mr. TIMMONS. First up, thank you so much for your attendance here today. You all are experts in your field, and we really appreciate you taking the time to come and share your thoughts on this important topic.

Congress is grappling with technology. Our country's grappling with technology. And we're doing our best to try to figure out a regulatory environment that fosters innovation and allows economic growth, while managing the potential adverse impacts that technology can have.

Obviously, we are working on cryptocurrency and digital assets, and that's a major challenge for us. Congress is not the youngest, most tech savvy part of our society, and we are doing our best.

But I do want to talk about AI's potential impact on our work force, particularly how tech can be leveraged to further individual efficiency rather than possibly displace workers.

So, Mr. Crowder, I want to start with you. What are the most promising use cases for AI as a tool in the work force, and how do you anticipate AI will be—will influence industries such as the financial services sector?

Mr. CROWDER. Yes, I think it's going to be pretty broad. And one of the exciting things that we didn't really talk about is that leveraging some of the underlying technologies like base or foundation models can be applied to things, not just writing a haiku or coming up with a speech, but also, you know, looking at language-like things in other fields, like tabular data and finance, et cetera, et cetera.

So, in addition to the kind of things I talked about fraud detection, I think we've all experienced, you know, maybe traveling abroad and having your credit card be declined, and that's bad for banks because they want that credit card money. So, even a small percentage improvement in false positives is a lot of money for our financial institutions. So, there's lots and lots of applications.

But to your point, I mean, I think we need to look at AI as augmenting what humans can do as opposed to replace. And I think good utilization of AI is to make it—make our work force more efficient. And I would argue one of the things that we do a good job

in the United States is funding basic science. But we also need to look at how do we encourage our work force to be able to use the technology as opposed to just develop the technology. Because I think the use of AI is going to be a differentiating factor on, you know, making the U.S. Government as well as our companies more effective and more competitive.

Mr. TIMMONS. As businesses try to compete in the free market, they're inevitably going to try to cut costs and replace work force with technology. What—how are we going to manage that challenge?

Mr. CROWDER. That's a good question. I don't know if I have a perfect answer for it. But I think having a more productive work force that is focusing on value creation, I think at the end of the day is what really drives success in business. And the more that you can automate tasks that aren't really value creation so you can free up your workforce to create value, I think that is good. And I think that is a more positive way of driving additional productivity as opposed to thinking about it as removal of cost.

Mr. TIMMONS. Sure, sure. Dr. Schmidt, what jobs do you think will be created in the wake of AI and what jobs do you think will be threatened?

Mr. SCHMIDT. I think one of the general comments to make is I've spent 20 years listening to the theme that jobs will be displaced or lost because of technology. And today we have a huge shortage of workers to fill the jobs in America. The biggest category is truck drivers. Remember how truck drivers are going to be replaced by automation.

So, it looks to me like the most likely scenario in the next 20 years or so is not enough people to fill these jobs. And the best way to get people who can fill those jobs, to have them have better tools, better education, better knowledge, and a partner, if you will—all of the evidence that I've studied indicates that having a digital partner increases your wage, right? Literally, when you are using a computer to help do the job, the job has a higher salary.

So, it looks to me like as we get more diffusion of this technology, on average, jobs go up. There are jobs that are lost, there are jobs that are created.

Mr. TIMMONS. Sure. I couldn't imagine my life without Google, Apple, and Amazon. I feel like I'm attached to my phone. And I haven't been to the grocery store in three years, and it is great. So, I'm sure that this is going to create additional opportunities to make my life more efficient and make me more capable of having a greater impact. So, I appreciate that.

And thank you, Madam Chair. I yield back.

Ms. MACE. Thank you.

I now recognize Congressman Lynch for five minutes.

Mr. LYNCH. Thank you, Madam Chair. And congratulations to you and to the Ranking Member.

Dr. Schmidt, in March 2021, the National Security Commission on Artificial Intelligence released its comprehensive, I think it was like 800 pages. It actually defended itself against the risk of being read by its sheer thickness. But right after your report came out, I was the Chair of the National Security Subcommittee, and we invited you to testify regarding that. I see your staff all nodding.

They have painful memories of this, I'm sure. But we invited you in, and we went over the report. It had 16 major recommendations, and then probably another 20 other subsidiary ancillary recommendations.

I'm wondering if you could talk about the progress, or the lack of progress, we've made over these two years now since you last testified before this committee about this issue.

You had some very pointed recommendations, you know, for DARPA. You had recommendations and action items for Congress, for the executive, for this interagency task force that you envisioned.

Can you talk a little bit about where you think—how much progress do you think we have made? And, you know, would you give us—what kind of grade would you give all of us.

Mr. SCHMIDT. Well, in the first place, you guys give us the grade, and we are happy to serve. I would say about half of our recommendations have been adopted through the NDAA and other processes. We were kind enough to write the legislation for you as a hint, and you all were able to adopt it fairly quickly, and it worked.

The area that I'm most focused on right now is basically the training problem. And I just don't see the progress in the government to reform the way it hires and promotes technical people. As part of the—part of the AI report, we proposed a civilian, essentially, trading academy for digital skills. And there are various different forms of this. But I don't think the government is going to get what it needs unless it has a program which is modeled on the military academies but for civilians, where civilians get trained in technology in return for serving in the government in the civilian capacity to help the government out.

This is a young person's game. These technologies are too new. You need new students, new ideas, new invention. I think that is going to be the fastest way to get it. I don't think the government is going get there without it. That'd be my highest—I think that's the largest omission.

Mr. LYNCH. Is there a way—so I actually was confronted with this same problem in my district, where a lot of high-tech firms, biotech firms moving into the district, and I grew up in the local public housing projects and those kids—our kids weren't getting those jobs. So, I started a—I founded a charter school that focuses on STEM, you know, math, science, technology. And it's doing really, really well. But it's one school, you know, out of a hundred.

And is there a way to—I'm not so sure if it is efficacious to try to take somebody who is coming out of high school or in college and then make them a tech person. I think it's a much longer runway and better chances of success if we start at a very early age. I mean, is there any thoughts about, you know—I mean, you know, we are having problems with our public education system anyway. But is there a way to amp that up at an early age in early grades to produce the type of workers that you envision will be necessary to maintain our edge, not only in artificial intelligence, but everything else we have got to do.

Mr. SCHMIDT. Israel does something interesting in this area. If you are 15 or 16 and a math prodigy, they actually put you in a

special school that is combined with their mandatory military training. I'm not suggesting a mandatory military training for our math people. God knows how they would do. But the important thing is identifying the talent early and then getting it into the right track. And, again, the educators to my left can talk about this at more length.

But I think that at a Federal level, the easiest thing to do is to come up with some program that is administered by the states or by leading universities. Every state has a big land grant university that is interested in this. And getting them money so that they can build these programs, and then they get paid back for that with service. I like those models, and that is a model that takes your idea and scales it. There is a lack of money to build these systems at scale, and that idea or some variant of it would do it.

Aleksander?

Mr. LYNCH. Thank you.

Yes. Mr. Mądry.

Mr. MąDRY. If I can just add, is that AI's technology is to learn best by applying it to used cases. And government—so I actually was discussing exactly this problem with DOD because they have exactly suffered from this—and instead of thinking of this is a weakness, this could be a strength. Once it is tried to apply AI internally to your problems, that's where people will learn. And this way actually people come, let's say to DOD, or to government programs for three, five years, and they come back to the civilian sector. And really like, also, well, we are lacking this talent also in our civilian economy too. So, I think that is the way to go, and the government could play a big role here.

Mr. LYNCH. Thank you.

Madam Chair, I know I have another one witness need to answer the question, but I think I've run out of time.

Mr. BURCHETT. Chairlady, why don't you let him go. I'm next, but go ahead.

Mr. LYNCH. OK. Ms. Hickok?

Ms. HICKOK. I just wanted to follow up with the last remark as well in terms of education. I echo the task force nationally. I researched task force reports and recommendations on democratizing the research and development capabilities within the Federal Government for the government as well.

Sometimes our brightest minds are forced to go to a handful of companies and labs and campuses to do their research in areas that they are interested. But if you have this capacity within the government's infrastructure as well, that would also be another way to attract this work force.

And I will expand also the education piece from the schools to consumers, and expand the education need from technology jobs to all the jobs. We need lawyers who understand these concepts. We need sociologists, anthropologists, ethicists, policymakers. We need understanding and capacity building in this topic across the whole domain and industry.

Mr. LYNCH. Thank you.

Madam Chair, I yield back. And I thank you for the courtesy, and I thank the gentleman as well. Thank you.

Ms. MACE. Thank you.

I would now like to yield to Congressman Burchett from Tennessee.

Mr. BURCHETT. I'd tell my friend across the aisle, you'll get nowhere calling me a gentleman; I just want you to know that. And I didn't miss my thought process when I came in here, and we have a lady who is chairman and it is international day of the woman. And I think that is pretty cool that you Chair. If my momma were alive, she would think that is very cool, too, because she was a pretty cool lady.

Thank you all for being here. I'm probably the least qualified person of ever asking y'all questions, but as the 435th most powerful Member of Congress, I feel very empowered today, and I'm kind of digging this subject matter. And I'll try to go through these quick.

Mr. Schmidt, I did Google, brother. And I don't know what it is. I hit that button—you know, my mom and daddy would always say look it up. Now I tell my daughter, Google it, honey. You know, so I think it is pretty cool.

But the development of AI, how will that impact our international relations specifically with China? I fear what they will do if they get control of it, as you have stated there. I think you mentioned the date that they said they were going to control it, and I would say they probably be doing that five years ahead of time.

Go ahead, brother.

Mr. SCHMIDT. Thank you, Congressman. I worry about the following scenario: In the future, there's a war. It's an attack by North Korea on the U.S. Sorry. China stops the war between North Korea and the U.S., and the entire war took one millisecond.

And the reason I worry about that is I can't figure out how we are going to build offensive and defensive systems that are reliable enough to put them in charge of a war that occurs faster than human decision-making. That, to me, is the ultimate threat of this technology, that the things occur faster than humans can judge them. I don't have a good solution for that.

My second observation is that China is very smart, and they have identified these areas as these underlying technologies to provide leadership that dominates industries. A good example is synthetic biology, which is an area which was imbedded in the United States, likely to be, again, trillions of dollars of wealth. China has now maximized its investment in this area. Not only is it good for their national security, but it's good for their businesses.

So, when you have got a nation-state that's smart, technocratic, focused on its own defense and innovation, and proposing its own companies in the form of civil military fusion, we have got a serious competitor. That's why we have to act.

Mr. BURCHETT. Are you aware—or maybe you are not. I'm not—of the Chinese infiltrating any of our AI companies?

Mr. SCHMIDT. I am not. You must assume the Chinese have operatives pretty much everywhere, based on their history.

Mr. BURCHETT. OK. Is there any way that we could proactively protect against AI-generated cyber attacks?

Mr. SCHMIDT. Well, you defend against them.

Mr. BURCHETT. Right.

Mr. SCHMIDT. Technology—we looked a lot at this. The question is could you create the equivalent of a Manhattan Project that was secret and you'd keep it all in one place, in one location, New Mexico, what have you. The knowledge is moving too quickly. There's too many people globally. We are going to have to win by staying ahead, which means building powerful defensive systems.

Mr. BURCHETT. OK. Thank you.

Dr. MaDry, what are some of the personal risks to personal privacy that are associated with the use of AI?

Mr. MaDry. Sir, could you clarify what kind of risk?

Mr. BURCHETT. Well, I guess I should ask my research person. As I stated, it is a little out of my league.

Mr. MaDry. No, I just didn't hear. I just didn't hear.

Mr. BURCHETT. No, I just said what are some of the potential risks?

Mr. MaDry. I see. So, again, there is many, and they really depend which sector you look at because there are different levels of credibility. So, one of them and like the one big risk, and that's something I research myself so I'm intimately familiar with, this technology is not fully reliable. It works most of the time, but not always.

Mr. BURCHETT. It's not fully what? I didn't—

Mr. MaDry. It's not fully reliable. So essentially, it works most of the time but not always. And then what is worse, you might not realize when it's not working. OK. So, for instance, in ChatGPT they hallucinate things sometimes, and you might not realize they are hallucinating things because it looks very convincing.

The other aspect of this is, essentially, as the systems ingest our data, they can really essentially know us better than we do. And again, that was true also of Google, also of the social media, but I think with this next generation of models, this will become even more so.

And then the third level of risk is exactly the one that Dr. Schmidt talked about. I'm actually really worried about that. Not even about the actual war happening, but us preparing for the war like something can go wrong. And it becomes like when things are happening within a millisecond, like, we have no good intuition or no good ways to actually figure out how to make it safe.

Mr. BURCHETT. OK. Thank you.

Running out of time but, Dr. Crowder, real quickly, how will the quantum computing impact the security of encrypted data?

Mr. CROWDER. In the long-term, quantum computers, someone proved on a blackboard, that a lot of our current cryptography, how we basically send keys around and how we digitally sign things, eventually will get broken by a quantum computer. The good news is that people have come up with algorithms that quantum computers are not good at solving and classical computers are not good at solving.

So, our challenge is really transitioning from the cryptography we use today to that new form of cryptography. And we want to do that as quickly as possible once we have got really safe standards because we're worried that people will take all the data today and decrypt it later. So, for some applications, that doesn't matter, but for a lot of applications that makes a big deal.

Mr. BURCHETT. OK. Thank you. I've run out of time.

Chairlady, thank you, ma'am, very much.

Ms. MACE. You did a great job.

I would now like to recognize Congressman Mfume.

Mr. MFUME. Thank you very much, Madam Chair. Again, my real thanks to you and the Ranking Member for having discussions that led us to this point.

This, for lack of a better term, has scared the hell out of me. And I thought I knew something about AI. I'm bopping around on the campus talking to students in a classroom now and then teaching them, but what I have heard today is unlike anything I have ever heard, particularly in terms of our national security.

I think the Chairwoman mentioned or quoted Einstein a few minutes ago. He also said that great minds have always encountered violent opposition from mediocre spirits. And I don't know if you are encountering violent opposition, but I think you are encountering a great deal of inattentive or unattentive population groups who just, for whatever reason, are not paying attention to what is going on. It is very scary, and I would strongly support, Madam Chair, any future hearings on this. I just don't think we have much of a choice. It is that imperative.

Dr. Schmidt, you said it was a national imperative, almost a national emergency. That got my attention, and it will keep my attention.

I don't know that we can do enough to ring the bell on this so that our institutions, whether it's government or business or academia, all start paying the kind of attention that we really, really need.

Dr. Madry, you, in your testimony, talked about the overarching points. And the fourth one you talked about was that we pay attention, critical attention, to the artificial intelligence supply chain, that it will structure the distribution of power in a new AI world. Could you take just a moment to explain that?

Mr. MADRY. Of course. So, essentially the way AI is being deployed right now is no longer just one entity who gathers the data, trains the model, and applies it and deploys it to a given task. The way things happen is that there is a supply chain, in particular with this new generative models, like, they are very expensive to train, but they are very capable. And essentially what happens is that, you know, one of these companies—there is very few companies that can afford training such a model—they essentially develop it and then let other companies build on top of it.

So, think of this as just like having initial capability and just adjusting it. For instance, you have a model like ChatGPT. It is able to summarize texts and understand to some extent the texts. So, maybe you have a hiring tool that then you build on top of it that essentially uses this capability to screen resumes and something. There is many risks there, but this is just an example. So, we are heading this kind of supply chain of interdependencies.

And again, we have upstream where there is very few players. There is very few critical important models on which a lot of the economy depends, and then there are all these interactions between these other things. So, this is something that now we have to think. There's an ecosystem.

Mr. MFUME. I see. I see.

This sort of boasting that China has been doing that, by 2030, they will be the dominant player is scary also. And the fact that the universities in Beijing and elsewhere are openly sort of trying to develop this and develop thinking that way, and that it's only seven years from now makes me, again, very concerned.

I want to talk about risk for just a moment, and then my time will have expired. This whole notion of a war and decisions being made with the use of AI in a millisecond that counter and then counter-counter the decision. I don't know to what extent the military establishment—I assume they're looking at this as much as you are, but it is interesting.

Now, I'd like to ask also, there are, as you know, fallible algorithms. You know better than I. They are just misleading or they are incorrect. What happens in consumerism, in business, in law enforcement, in military context that frighten you the most as risk as a result of an infallible algorithm? Any of you?

Mr. SCHMIDT. Quickly, the biggest issue, as I mentioned, is the compression of time. Let's assume you have time. Then the question is, who gets to decide between the system and the human? And I'm very concerned about a misalignment of interests where the human has one set of incentives, the computer has been trained against a different set of outcomes, and the whole society wants an even different goal.

And I spent lots of time with the military, who I'm really, really proud of and fond of, and they all want systems that help them automate their decisions. In practice, their use of technology will be largely to replace boring and uninteresting jobs, like watching TVs and things like that. These are things like Project Maven and its successors and so forth. So, I think at the moment, the government at the military level is going to use these more for sensing and analysis and not decision-making. Just to make it very clear, I think we would all agree it is not ready to make a final life critical decision. It may never be, but it is certainly not now.

Mr. MFUME. Yes. Thank you. My time is expired.

Thank you, Madam Chair, appreciate it.

Ms. MACE. Thank you. Great questions.

I would now like to recognize Congressman Burlison.

Mr. BURLISON. Thank you, Madam Chair.

I, for one, am not afraid of the advent of AI. In fact, I want to welcome our future overlords. But I will say, I do see a lot of promise. You know, working in healthcare technology, we see an amazing opportunity to be able to comb the data records of patients, be able to use—be able to take that data and be able to accurately diagnose better than probably any medical professional possibly ever could to a greater degree of accuracy what you might be facing. To me, there is tremendous opportunity, but I also do recognize some of the threats, obviously.

To that end, my question for you, Dr. Schmidt, first is that, given the state—the size and scope of the equipment that's necessary today, we're limited to what actors do have the ability to use AI, right? So, at least we know who has access to it, who's utilizing it. It's not like we have people in a Nigerian criminal syndicate using AI at this point. Is that correct?

Mr. SCHMIDT. I can assure you it is coming because of diffusion. Basically, the models are trained very expensively, but when they're used for inference, which is where they answer questions, it's quite simple. So, I would expect us to see terrorists, other bad actors begin to use this technology in ways that we should anticipate.

Mr. BURLISON. And they—but at this point, they would have to access it on another platform. Someone would have to spend the resources to develop the tech—to house the data, et cetera?

Mr. SCHMIDT. And Aleksander can—Professor Madry can help me here because we work together. The simplest way to understand it is the training part is really expensive, but you can take the trained information and put it on a laptop, and then it can be used. So unfortunately, in this scenario, all you need is a computer or a phone to do your evil acts.

Mr. BURLISON. OK. Dr. Crowder, my question to you relates to the quantum computers. These too, these are machines that you just couldn't walk around, handheld devices, right? Can you walk us through what it takes to—what the environment requirements are, what it takes to have a quantum computer?

Mr. CROWDER. Yes. I mean, the—we deploy them right now in regular data centers, but they are not laptops. They are not mobile phones. They are large, complex systems, and they are very, very hard to calibrate and manage, and that is a major trade secret of how to keep them up and running. That's probably going to be true for quite a while.

So, you know, right now, we don't actually sell systems. We sell cloud access, because there's a small number of people who know how to actually keep them running, operating, et cetera, et cetera. So, you know, obviously that has some benefits from an IP protection security point of view as well.

Mr. BURLISON. And so, this is being used at what scale? How many businesses or—

Mr. CROWDER. So, we have over 200 partners, and we carefully select what regions of the world we do business in and carefully select who we partner with. But we have got over 200 industry and academic and research partners who are leveraging—we've got about 26 computers right now that are accessible via the cloud.

Mr. BURLISON. To that end, I know that from other testimony from other hearings, we have been hearing that the Chinese Government has a pattern of sending students to American universities, who then are able to glean data in working in cooperation on some of these projects.

Are you aware of that activity?

Mr. CROWDER. Not personally aware of that activity. We obviously are very—for business reasons for our, whatever you want to call them, crown jewels or most protected IP, we are very careful not to—we are very careful who is part of that work.

Mr. BURLISON. And then again, my last question to you is, in the subject of quantum entanglement, has that had any real world applications or potential real world applications?

Mr. CROWDER. Right now, nobody from our perspective have proved that there is practical use, which means it is better than simulating it or just using classical computers. But we think that

is going to change in the next very soon amount of time. The computers are getting rapidly advancing, and we think by the middle of this decade, there will be practical use.

We are working with a lot of, you know, U.S. companies on applications today. I had mentioned a couple of them before, like Boeing on looking at better airplane wing optimization materials, fraud detection for banks, looking at medical health records and trying to predict more efficient treatment for patients with healthcare, like sciences companies. We have a big partnership with Cleveland Clinic looking more broadly across five sciences. But it is not practical today to be better than what we have classical. But we think that's going to come in the next couple of years.

Mr. BURLISON. Thank you.

Ms. MACE. Thank you.

I would now like to recognize Congressman Gomez for five minutes.

Mr. GOMEZ. Thank you, Madam Chair.

Before we begin, I want to—I was thinking about this: How do we rank AI in the history of development in humankind? It is something that I believe is—could be extremely startling. It's one issue that I have random people bring up to me on the streets. Some people compare it to the invention of the television or computer, or the internet, and I think it's beyond that, because this is something that—it makes it hard to discern something that you are looking at, a photo, a video, or even words on a piece of paper if it was actually written or developed by a human.

And that is something that I think most people are trying to wrap their minds around. How is this revolutionary technology going to fundamentally change the way we live our lives, the way we interact with one another, the way we interpret information that is coming in? Because when you can't discern what is actually created by a person and what is developed by a computer program, then people start questioning all sorts of things.

And that's one of the challenges. Maybe that is a philosophical challenge. Maybe it is a real life government regulatory challenge, but it is something that really, I think, is at the heart of it, when people start to question what is real and what is not.

But I recognize it has—AI has a lot of great potential. Everything from predicting new variants of COVID to detecting certain types of cancers that doctors miss. The potential is staggering. But people want guardrails on this new technology. If not, it can and will be misused.

When I first got elected, one of the—somebody ran a test of Members of Congress, and there was about—I think it was about 28 of us that got matched with people that had committed crimes. And this was under the best circumstances. They were using our photos from our websites that were taken with the best lighting and the best quality. So, AI has a potential also to have inherent bias built into it, and it often disproportionately impacts people of color, women, and that is a concern.

So, how do we address those limitations on AI? How do we safeguard against the violation of people's civil liberties? And this is something that even my—when Mark Meadows was on this com-

mittee, him and I and others agreed that this was a problem. We just couldn't figure out a solution.

So, Ms. Hickok, how can Congress best help address AI's racial bias? What can we do as a body and the Federal Government do to protect individual's civil liberties and, at times, their right to privacy as well?

Ms. HICKOK. Thank you for the question. And I'm really thankful that you mentioned the civil liberties, because with AI systems, as I mentioned earlier, you're talking about every single industry and domain that is going to be—is going to be even further impacted by this.

You talk about civil liberties and access to resources and, unfortunately, that spans from anything from housing to employment to education to insurance loan to policing and criminal justice decisions and judiciary decisions. My concern is, as AI also, if you don't have the guardrails now and these systems are imbedded in the public sector services as well as private services, that they are also going to eventually connected.

So, one erroneous decision from one system is going to be the input to another system, and we are going to completely lock people out of resources and opportunities, and that is going to widen the gap between haves and have nots. And it is also going to widen the gap within the society that we are all trying to narrow.

How can we narrow that? How can we keep the systems accountable? It is really about the people and organizations and how we use them that we should be focusing on. Putting the civil liberty is putting the freedoms and rights at the center of it, and making sure that these systems—the systems that we use, especially that impact the resources and the rights, are built accountably, transparently, replicable. We heard from my co-panelists and witnesses that a lot of the times the systems are opaque. We don't know how they work, and we also cannot replicate the decisions.

So, you might be denied a credit. You might be denied insurance or a job. It might not be—if you are trying to keep the organization accountable, we will not be able to trace back and keep them liable as well. So, we need to make sure from the start, from the very start, from the design data and design stages, that we put those guardrails in place, and we keep organizations and the users accountable.

Mr. GOMEZ. Thank you. And my time has expired, but the question is: Is it too late to put those guardrails on?

Ms. HICKOK. It is not at all. In fact, at CAIDP, our students, especially our law students, asked that question last week, is it too late, is it inevitable, has the ship sailed? No, it is not. The humans, organizations, lawmakers, the humans, the users behind it hold the power.

Mr. GOMEZ. Thank you so much. I yield back.

Ms. MACE. Thank you, Congressman.

I would now like to recognize Congresswoman Greene.

Ms. GREENE. Thank you. I think this is a very important hearing to have as AI is progressing and working in a lot of different sectors. And I really appreciate each of you being here.

I'm definitely not an expert in AI, but I would like to talk about the fears and concerns that people in my district and people all over the country have when it comes to AI.

We certainly don't like the idea of AI replacing humans and replacing people, especially when it comes to jobs. And so, when there's headlines like Alphabet announcing 12,000 job cuts globally while chief executive officer singled out AI as the key investment area, that is what people start to think about. Or when Microsoft announces its \$10 billion investment in OpenAI just days after saying it would lay off 10,000 employees, those are the kinds of things people think about.

Now, there is a difference between robotics and AI. Obviously, robotics are a good thing. For example, tightening bolts or moving heavy objects like in manufacturing, we really appreciate that. But when it comes to AI being able to be smarter than humans or replace humans on the job, I think that is a major concern, especially for a country that's over \$30 trillion in debt and an economy that is struggling.

This is something also concerning for education, learning that ChatGPT scored higher than many people on the MBA exam that was administered at Penn's elite Wharton School. That's definitely concerning, especially when thinking about how that could affect education. Just recently, ChatGPT was—is currently banned in New York City schools over cheating concerns, but then you think about what would this look like if AI became teachers, especially after the devastation caused to children's education levels, but also more importantly, kids being taught at home on computers. That was more devastating to them.

The idea that AI could replace software engineers, journalists, graphic designers, that is also extremely concerning. So, I think these are important conversations to have.

But something that happened, I just learned about in researching for this hearing, was that there are scams that happen to people where AI is so intelligent, it is able to imitate people's voices and images. And there is been people taken advantage of in horrible ways where they have gotten phone calls from who they thought was their loved ones but was not. And their loved one, which was really an artificial intelligence voice, mimicking their loved one was calling for help in serious distress, and then they got scammed out of a lot of money. That's terrifying and concerning that that can happen.

But another thing that happened recently was when San Francisco officials voted in December against a controversial measure that would have allowed police to deploy robots to use lethal force in extreme situations, but this happened after the San Francisco Board of Supervisors came a week—it was a week after the board voted to approve the policy to allow what people called killer robots. But this is what people think about when they think of AI. They think of a robot that has the artificial intelligence to replace the police officer.

But then the application to the military is where I thought was pretty concerning.

Dr. Schmidt, I wanted to ask you, because I took to Google on this issue. And I wanted—I saw a headline that said "AI's impact

on warfare will be as big as nuclear weapons.” And I also saw another headline that said “Eric Schmidt Is Building the Perfect AI War-Fighting Machine.” So, I thought you would be the perfect person to ask about this. Could you explain a little bit?

Mr. SCHMIDT. Let me be clear, that’s for the benefit of the United States.

Ms. GREENE. Only if it is in the United States’ hands, though, Dr. Schmidt.

Mr. SCHMIDT. And it will be.

The trends in the military are fundamentally autonomy and drones and intelligence sensing gathering. The military spends most of its time looking at things and trying to analyze it. So, in the near term, the benefits to the military are profound. It allows the service people who we have trained exquisitely who are watching dumb screens to use their higher factory skills and have the computer say, hey, look, this tank moved or, hey, this thing happened over here, can you analyze it.

I think a better framing for your constituents’ fear is to say that AI will make the people much more successful in what they do, and that will drive higher incomes, higher jobs. And I think that that’s the best, at least in the next 20 years, narrative about AI. It is true in the military. It is true in civilians as well.

Ms. GREENE. One more question. My time is expired, but how do we—with China and their ability to constantly spy on us and steal our technology and information, how could we prevent China from stealing this type of artificial intelligence with our military? And thank you.

Mr. SCHMIDT. Of course. The bad news is that these research ideas are in the public domain and international, so we can’t prevent China from getting it. The Trump and Biden administrations have done a good job of restricting access to hardware, which is helpful. So good job, all of you.

With respect to software, the biggest answer is more software people, trained in the West, trained under our values, building systems that you as our Representative have some level of regulatory control over. When they do it in China, you can’t pass a law to change that, but you can in the United States.

Ms. MACE. Thank you.

All right. I would like to now toss it over to Congressman Khanna for five minutes.

Mr. KHANNA. Thank you, Madam Chair, and thank you for your leadership, for your bipartisan cooperation and collaboration on the quantum bill, and the approach you have taken to work across the aisle.

Dr. Schmidt, I respect your leadership in Silicon Valley. There’s a paradox in my mind that I would love your insight. On the one hand, DARPA in the Department of Defense gave us the internet, as you know, with Vinton Cerf, gave us GPS, gave us the drone, gave us the mouse, probably the most innovation in the history of the 20th century, defense technology. And yet, now it seems there is this problem of the adoption of innovative technology.

Why is the model that gave us all of this revolutionary technology not working?

Mr. SCHMIDT. Thank you, Congressman. And you have really helped in a lot of these areas.

If you go back to Vannevar Bush, the National Science Foundation, and DARPA, those are the engines that got us all here. We are all here fundamentally because of early decisions made by the Federal Government to invest in researchers who then we built on top of. So, I'm incredibly grateful to them.

In the case of the government, and particularly the military, those innovations go into a bureaucracy that is not organized in a way to take them. And a simple example is software. The military is organized around procurements of a 15-year cycle and complicated bidding among a small number of contractors. That is not how software works. And a number of us have worked hard to get software treated more as a continuous process. But the military, for example, would benefit by a large expansion of a number of more software people, just fixing stuff, making things work, making them smarter. That is a simple thing that you could do.

Mr. KHANNA. To that end, what do you think about an actual service academy around technology, cyber, AI?

Mr. SCHMIDT. We looked hard at creating a military service academy when I was doing the AI commission. And the military has really, really good people in their academies. And what they do is, because of the way military promotions work, you take some brilliant person, you make them go stand guard duty for a while, which is stupid. Sorry to be blunt. It is much better to change the HR policies, which the military is trying to do now. In particular, Secretary Brown in the Air Force is trying to create a technical path to keep these people. That is how you solve that problem. And let me give the rest of my time to Aleksander.

Mr. MADRY. Yes. So, I just wanted to add because it is a very important question that you ask. So, I actually happen to co-lead and codevelop at MIT an executive education class, AI for national security leaders, which essentially hosts a number of general offices from Pentagon and other places to come and learn about AI. And this is a three-day program. Half of this program is not about AI; it's about organizational management aspects.

So, this is what you recognize. There's a lot of frustration in DOD in your top military leaders that the technology is developed. DARPA did their part, although they should do more particularly in generative languages. But then we hit the bureaucracy. And there is just a lot of organizational problems that are kind of silly that the DOD is completely crippled in terms of adoption of AI. So, that is where we need the attention.

Mr. KHANNA. Well, I look forward to working with you [inaudible] with Representative Mace and Representative Gallagher.

One other question—I mean, I'm back home in Silicon Valley. It seems the new thing there is everyone is doing AI. I'd be curious, Dr. Schmidt and Dr. Madry, how do you see—will Silicon Valley lead the world in AI? How are we doing compared to China?

And then one comment from my own version of American exceptionalism, it drives me crazy when Europeans are lecturing us about AI and technology. You know, I don't see Google, Apple, Tesla. I get they say they are going to innovate in policy, they are

going to also innovate in technology. How are we compared to Europe as well?

Mr. SCHMIDT. My cynical answer about Europe is that Europe is going to lead in regulation and, therefore, not lead in anything else. Their efforts do not appear to be successful, as you have pointed out.

The reason we are so excited about AI is that anything that makes humans smarter and makes algorithms smarter and makes discoveries quicker is a horizontal technology that is transformative. The opportunities to make basic advancements outside of language models, right, are profound in terms of science, materials, plastics, every kind of logistics, every kind of analytical problem, as has been summarized by the panel.

So, I think that AI is here to stay. It is the next big wave. I don't know when it will end, but we are still very early. Remember, we still don't understand exactly how these algorithms work. We also don't understand how big the models have to be. At some point, we'll know. But we are not anywhere close to being able to answer those questions.

Mr. MADRY. If I can just add very quickly because you asked the question about Silicon Valley. Silicon Valley is doing great. They will do great job. They are clearly harnessing this progress, but we as a country should not abdicate the progress on the strategically important technology just for Silicon Valley. Again, they will do great, but we should be doing more, and the U.S. Government should be doing more.

Mr. SCHMIDT. Speaking as a professor at MIT.

Mr. MADRY. Yes. But I like Silicon Valley.

Ms. MACE. In closing this afternoon, first of all, I just want to thank you all, all of our panelists for your time and your talent and everything that you have shared with us today.

This will be, Congressman Mfume, the first of a series of hearings that I hope that we'll have on AI. I don't think that we are ready for what is going to happen in a very short period of time. And I think, if it is not happening already, it will be in the next five years where AI will be programming AI, and then what's next?

And so, this was a great first discussion to start this conversation about what needs—what we need to be talking about in regards to this.

So, in closing, I want to thank all of our panelists once again for your insightful testimony today. You have given us a tremendous amount to think about, and AI was created by humans, but it doesn't mean that it is going to be easy for all of us, especially up here on the Hill, to grasp what is before us and what is imminently coming. We appreciate the panel's expertise and ability to shed light on the state of the science and the broader societal implications that policymakers must consider.

And I would like to yield to the Ranking Member, Congressman Connolly, for your closing remarks.

Mr. CONNOLLY. Thank you so much, Madam Chairwoman.

And I found this an intriguing conversation, but wanting more. And like Mr. Mfume, I think we have opened the door to a lot further in-depth exploration, hopefully by this Subcommittee and by the Congress, because there are lots of issues we have to face.

And while you may be right, Dr. Schmidt, about dismissing the Europeans as regulators but not innovators, on the other hand, given what we heard from Ms. Hickok and Dr. Mądry about the need for some Federal intervention here, there have to be guidelines and guideposts so that we are off on the right foot and not facing profound issues later on where the technology is advanced and we never either anticipated it or addressed it. Maybe there are things we can learn from the Europeans in the regulatory guidelines, either things not to do or things to do.

But any rate, I just think there is a lot more for us to explore, and I really appreciate this being the first of a series of hearings.

Thank you, Madam Chairwoman. I yield back.

Ms. MACE. Thank you. And I look forward to working with everyone on both sides of the aisle on this issue. It is very important.

With that and without objection, all Members will have five legislative days within which to submit materials and to submit additional written questions for the witnesses which will be forwarded to the witnesses for their response.

If there is no further business, without objection, my first Subcommittee stands adjourned.

[Whereupon, at 3:57 p.m., the Subcommittee was adjourned.]

