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AI FOR GOOD GLOBAL SUMMIT
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>> Ladies and gentlemen, may I please ask you to take your seats? We're about to begin our opening ceremony.

Thank you. Excellencies, ladies and gentlemen, I am Patricia Benoit-Guyot, chief of protocol of ITU, and It is my great pleasure to act as master of ceremonies for today's opening ceremony. On behalf of ITU, partner U.N. agencies, It is my great pleasure to welcome you to the second AI Summit for global good. This morning we will receive a comprehensive introduction to the aims and processes of this action-oriented Summit. In the opening session, to explore the significance of AI for Sustainable Development we're privileged to welcome the leaders of ITU, WHO, and others to deliver opening remarks. I welcome to the podium ITU Secretary-General Houlin Zhao. Please.

>> HOULIN ZHAO: Professors, researchers, academia, experts, good morning.

Welcome to ITU. Welcome to the second AI for Good Global Summit. Since our event, we're trying to be action oriented and solution-focused at this team. Last year the Summit sparked an inclusive global dialogue ensuring a beneficial AI. It was the

first ever event of this kind. This year, we hope to spur action to ensure that Artificial Intelligence accelerates progress towards the Sustainable Development Goals and we're looking for concrete projects.

AI is making its way out of research labs and into our every day lives. Big data is a driving force. This has seriously implications for privacy and security. At the same time, this data revolution could help us tackle humanitarian's greatest challenges. Already AI solutions are being developed to help increase those managing natural disasters, reducing route conjunction and diagnosing heart, eye and blood disorders. At the ITU we hope that these solutions will help us connect all the world's people such as by deploying broadband infrastructure to those that need it the most. It is just the beginning.

Artificial Intelligence has the potential to transform areas drivers as critical as finance, mobility, energy. Over the next three days, our objective is to connect AI innovation, innovators with the public and private sector decision makers so that they can take promising strategy forward. I want to thank our partners, I'm glad that my good friend, Mukhisa Kituyi, and WHO Director General, of course my friend also, Tedros Adhanom Ghebreyesus, could be with us here today. From development and to health and to the environment, U.N. agencies bring the world he a expertise to the debates making the AI for good series the leading United Nations platform for dialogue on Artificial Intelligence and is the leader U.N. agency in Information and Communication Technologies, ICTs. ITU is encouraged by the high-level of cooperation between our sister U.N. agencies, with the industry and with the NGO and am deem I can't and community. My special thanks to the Kingdom of Saudi Arabia, the Kay family foundation, the PWC, the zero abuse project and the sage foundation for their generous support.

Ladies and gentlemen, on Thursday, May 17, we have telecommunication and federation society, it is a day that marks the first for ITU. This year we'll have a chance to meet four extraordinary women who have left their mark on the history of space exploration. They will tell us how ICTs have changed their lives and how AI might change our understanding of the universe. Like every year, this day, it is an opportunity to learn about the possibilities that ICTs can bring to societies and economies as well as ways to breach the digital divide and we're all here today to make AI and ICTs in general accessible to everyone because we all have an important role to play in balancing technological progress with social progress. It is transformative but also a safe and inclusive AI, we're required unprecedented collaboration. This week is a moment to assess the moment to look at applicable AI applications with the

potential to accelerate progress towards the SDGs and improve the quality and sustainability of life on our planet.

I wish you all a stimulating, fruitful Summit over this next three days.

Thank you very much.

>> PATRICIA BENOIT-GUYOT: Thank you. A great proponent in the field of heath, it is my pleasure to introduce the director of the World Health Organization, Tedros Adhanom Ghebreyesus.

Doctor, please.

>> TEDROS ADHANOM GHEBREYESUS: Good morning, and thank you to master of ceremony.

Dear brother Houlin Zhao and another brother, Mukhisa Kituyi, colleagues, distinguished ladies and gentlemen, first of all I would like to thank ITU for including the World Health Organization in this very, very important event. You know, I'm not an Artificial Intelligence or AI expert. I realize what AI can be used for. I believe the subject of AI for health is both important, useful for advancing health for all, and I understand this conference has both highly specialized AI experts as well as subject matter experts from the Public Health and healthcare providers.

With that, let me make brief remarks. A few weeks ago we celebrated the WHO's birthday, we were founded in 1948 on the conviction that health is a Human Right to be enjoyed by all people, not a luxury for the few. Health as a right issue and in in itself, but also as a means to development. That conviction is as strong today as it was at first. The top priority, it is universal coverage. Ensuring that all people can access the health services they need without facing financial hardships. The foundation for achieving this vision is strong based on primary care that delivers the services that people say they need rather than other people besides that they should have. Unfortunately, we're a long way of realizing this vision. WHO's latest data show pace at least half of the world's population lacks access to essential services and almost 100 million people are pushed into extreme poverty every year because of out of pocket spending.

In less than a week's time, health Ministers from around the world will be gathering here for the World Health Assembly. Among the many issues, resolutions, they'll be considering the WHO general programme of work, our strategic plan for the next five years. The plan articulates our mission to promote health, to keep the world safe and to serve the vulnerable. To keep ourselves accountable we have set three strategic targets, 1 billion more people benefiting from universal health coverage, a billion more people better protected from health emergencies and 1 billion more people

enjoying better health and well-being. What we call triple billion targets. Digital technologies and Artificial Intelligence will be vital tools in achieving all three of these targets.

Electronic records for ensuring continuity of care, Artificial Intelligence is playing an increasing role in this and against outbreaks. Digital technologies which are vital already, they're becoming more and more integrated into treatments as well. The world today is very different from what it looked like 70 years ago, although communicable diseases like malaria, TB, they're still with us, the biggest killers today are non-communicable diseases that are associated with increasing affluence like heart disease, cancer and diabetes. Another immediate challenge is the practical difficulty of delivering health services to every person in a country in an equitable way, but today digital technologies and Artificial Intelligence gives us a world of tools we did not have 70 years ago. Mobile technologies, tele medicine can make a huge difference in helping reach people in the remotest villages with medical services. For example, Rwanda is piloting the use of drones to deliver blood supplies. By the way, while I was preparing for this I was in DRC yesterday, where there is an Eboli outbreak and I was at the epi center of the outbreak, and I was thinking about how can we really speed up our use of AI and other digital technologies, especially emergency situations. It is possible. This Summit, I want you to give it actually more attention and discuss about the use of AI and digital even more strongly in emergency situations.

More than 120 countries have now developed digital strategies. This number, it will only increase. This is an important area of WHO's work.

For example, the be mobile project between WHO and ITU, it is scaling up the use of mobile technology in priority countries to deliver health messages, including smoking cessation campaigns in Costa Rica and help for people in Senegal to manage diabetes during Ramadan. The use of big data and machine learning hold a promise of transforming health at the population level for example, Artificial Intelligence can help our response through enhanced early warnings of outbreaks forecasting things and improving decision-making for outbreak response and simulation tools.

At next week's world Assembly, our 194 Member States will be discussing a resolution on digital health which will no doubt include discussion on the use of AI for health. There are clear opportunities to use AI to make services both more accessible and more effective by making data collection more efficient. AI can reduce the cost of care making services more affordable for

patients, collecting more and better data, services tailored to people's needs, leading to better health outcomes and better performing systems. It would also help us predict the risk of future events from collected data. For example, the onset of the health attack in a patient with a high blood pressure. The benefits of Artificial Intelligence is not only a hope for the future. There are many examples of how Artificial Intelligence is already advancing health.

For example, AI will give patients improved mobility to make information faster and to look at emerging diseases and the threats and to manage road crashes, reducing crashes and increasing Road safety and to develop new medicines and vaccines and there is numerous other ways. Of course, with every new technology there are always risks of abuse, even as we enjoy the benefits of Artificial Intelligence we must not lose sight of Human Rights. We must ensure that national governments have the appropriate guardrails in place. WHO stands ready to support all countries both to realize the promise of Artificial Intelligence, and to ensure the appropriate safeguards are in place.

Although AI is the future of health, but safeguards are important too.

Thank you, once again. I wish you a very productive meeting. I very much look forward to reading the outcome of this very important Summit. I would like to finally underline our really strong partnership with ITU and my brother Houlin Zhao, we're working very, very closely understanding that AI's contribution to the future of health is very great and we have to embrace it and we're doing it by putting the organizations closer more than ever before.

Thank you so much.

>> PATRICIA BENOIT-GUYOT: Thank you, doctor.

Recognizing the benefits of Trade and Development in the obtainment of the Sustainable Development Goals, I have the pleasure to invite the Secretary-General of the United Nations conference on Trade and Development, Dr. Mukhisa Kituyi to speak to you.

>> MUKHISA KITUYI: Our dear hosts, ITU, Houlin Zhao, my colleague and friend Tedros Adhanom Ghebreyesus, members of the panel in front here, Excellencies, ladies and gentlemen, on behalf of the United Nations conference and trade development, I want to extend our invitation to the delegates coming from Geneva and express our appreciation to the hosts for putting together this important meeting.

Mr. Houlin Zhao and I have been working with relevance to this meeting very close and last week we were together on the broadband commission and yesterday we were opening a commission

on science and technology that I'm hosting this week. To me, a discussion of Artificial Intelligence falls very much in the place of discourse about technology, innovation, inclusive development. One of the challenges we face is about emerging technology, the Digital Economy, the Internet of Things, the industrial revolution. It is a balance between the potential spin-offs of positive impact of technology and the scare of what would become vulnerable -- and the scale of what could be vulnerable too and sometimes the most color. Language is spared for mongering on how Artificial Intelligence is going to create monsters that will shape what happens, statements like technology is going to do the following, it surprised us, because up until now, humanity has decided what technology should do. A statement that we're making regarding technology, it frightens and sometimes takes away attention from the critical potential of harnessing the potential that comes out of technology changes to serve human courses.

These kind of a balanced discussion is most clear when talking about Artificial Intelligence, robotics, autonomous machines, particularly autonomous weapons and we at the development conference between technology and trade have had this sense, first of all, that to go to the mid Level of debates about more equitable access to the benefits, the spin-offs of technology and understanding the dynamics that are part of the technology development, it will be very important at this time when that's the main driver of global trade.

For example, in the world information economy report in 2017 the global trade in robots, 1.6 billion robots were out in 2017 and 43% of these was in the U.S., Germany, Japan. The main next category group of countries that were major producers or importers of robotics were China, South Korea, Britain. Now what's this mean? First, that the potential benefits, which include for trade purposes the global value changes, reducing physical distance between design, production, marketing is most impactful and will be in a limited number of markets. Secondly, it brings a discussion of the shifting higher value in reproduction services like design and research and development and post production services like marketing and for cell services. If the developing world, it is mostly in the developing segment of the process and the value rises because of new information technology, it is in the -- what will migrate? Is the services going to migrate through the Developing Countries where the production is happening? Will production be Domesticated where design and marketing services are concentrated. These are major developments of questions on the issue of prosperity.

Having said that, we still have important ideas on

technology. First of all, in skill development, inadequate development of infrastructure enabling, the possibilities of a digitalized world, it is geographically unequally distributed. In the broadband commission last week I was raising a concern that the world today is rushing to find financing for 5G technology, which is not just incremental technology from 4G but can again change the ecosystem of the Internet of Things. What does that mean? What it means, that the corporate sector which has been through impact investment, social investment, they contribute to the infrastructure for inclusion of Developing Countries, it is going to concentrate resources in the 5G requirements. How will we fill the gap in financing? When looking at 5G, other societies are not completely working with 3G, how will the catch-up happen? For us, a number of things become developmentally important.

One, we quickly and rapidly identify gaps in digital compliance as a development challenge. The absence of coherent regulatory frameworks, privacy laws, the absence of many countries of physical and virtual infrastructure, content development, skills in education, curriculum, it is critically important as catch-up exercises so while the cutting edge of the different components of the digital revolution before the industrial revolution, it has to continue and the ecosystem has to be sustained. The ability of catch-up, of others, has to be mainstreamed as part of our collective challenge to the world. Three weeks ago at our annual eCommerce week I hosted in Geneva, there was a government Expert Group on eCommerce making statements about clear areas where we need certain changes. One, the cycle between new digital focus and the customized demands, it has to look at greater role and get embed.Of Developing Countries. Secondly, access and ownership of capacity for organizing and transforming data, it is increasingly important at a time when major platform trading companies will give away services for free in exchange for consumer data which they can mine at much larger benefits than just the product that's been given away. The chain in value of data as a main currency of global engagement has to be in national policy across disciplines, across all of government for our project. We wish you good luck and stand committed that we'll work with international community to find what possibilities exist, innovative technologies and responsible use and regulation of the use of the technologies for the benefit of mankind and closing the gap of digital equality.

Thank you for your kind attention.

>> PATRICIA BENOIT-GUYOT: Thank you, doctor.

To highlight the importance of education and technology the President of ACM, the world's largest scientific computing

society, I would like to invite Vicki Hanson.

>> VICKI HANSON: Thank you.

Good morning.

Good morning distinguished colleagues.

It is amazing to think that the era defining science fiction film 2001, a space odyssey was released 50 years ago this spring. To those of us that saw the movie in the theaters, no other book or film so vividly encouraged us to imagine a future where humans and intelligent communities worked together toward a common goal in harmony. In the movie, the classic scene of a gleaming white space ship gliding through space to the Soundtrack conveyed a future where technology would help humanity reach ever higher levels of achievement. By the end of the story, we all know, we were disturbed to learn that the computer had an Agenda all its own. This is the kind of thing that happens to me every day with my own computer still now. Today though many people still have the same feelings that theater goers had back in 1968. Intelligent machines have the potential to be a Boone to humanity. How can we achieve these technologies and make sure that they remain with the end to have a common good for all of us.

Our first step in answering this question should be to foster a greater awareness of the opportunities that new technologies present. Because of the pace of technological development can seem to take on a life of its own, we might forget that it is fully within our power and actually I would argue that it is fully within our responsibility to direct that development in a way that benefits society. The emergents of new technologies on the world stage should also encourage us to revisit with a fresh eye some old problems that we thought were not solvable. We should be aware of the fact that AI technologies currently used in business and other applications could be extremely helpful in efforts to elevate poverty, protect the environment or improve education. If they were slightly reimagined, refashioned to a new purpose. In other words, AI solutions, the urgent challenges in society may be hidden in plain sight right now.

This is why the AI for good global Summit is so valuable. It encourages all of us to think along these lines, to have interdisciplinary conversations with colleagues and fields we seldom have the opportunity to speak with. By bringing together the world's top AI talent with specialists in areas across the U.N. 17's Sustainable Development Goals there have been many valuable forums in AI in recent years. What makes the AI for good global Summit unique is the emphasis on action, to develop specific strategies that spell out how AI technologies can be put into practice to address the U.N. goals.

With nearly 100,000 members and 1 # 90 countries around the globe, ACM, the information for computing machinery is the world's largest computing organization. Our participation here is an out growth both of our organizational ethos and our history. At ACM we see a world where computing helps solve tomorrow's problems, where we use our knowledge and skills to advance our profession and to make a positive impact.

ACM has been an incubator for Artificial Intelligence since the dawn of the computing field and has published most of the important research in the field through journals such as ACM transactions on information systems and technology. Computing's most prestigious award, the ACM AM award often referred to as a Noble Prize of computing, was named after Alan Touring who himself inspired work in Artificial Intelligence. In the 51-year history this award has recognized several prominent AI researchers, including Marvin Menski in 1969, then later, Alan nuel and Herbert Simon and John McCarthy. John McCarthy who is credited with coining the term Artificial Intelligence in 1955. More recently AI researchers receiving the award include Edward flagendown, raj ready and judai pearl.

The field has made enormous strides in the past ten years bringing AI out of the lab and more fully into our daily lives. With these developments, it is no surprise that organizations concerned with AI have sprung up recently and important discussions are being held on present and future impact of AI and society. ACM has been active in these efforts. For example, we're a member of the partnership on AI and industry and NGO consortium that works to formulate best practices on AI. In the policy space last year ACM issued a joint statement from our U.S. and European policy councils on the needs for algo rhythmic transparency and accountability. I suspect that the AI for good global forum came back because many of you working in the U.N. have witnessed firsthand how technology has transformed lives. However, the popular press, and many of the technology communities itself is sensitive to anxieties that technology development has created. As a computing community, there is a need to counter misunderstanding and address ethics in computing through both policy and public education. On behalf of the entire ACM computing community I welcome you to the AI for good global Summit. AC, in looks forward to engaging with you this week and in the year's ahead.

Thank you.

>> PATRICIA BENOIT-GUYOT: Thank you.

Our final speaker today is a very dynamic, the global leader of innovative competitions, the XPRIZE to solve the world's grandest challenges, Anousheh Ansari.

>> ANOUSHEH ANSARI: Good morning, everyone. Thank you for

being here.

We're very proud to be a partner on this second annual AI global -- AI for good global Summit. For those of you who do not know us, XPRIZE was started very late in 1990s on the principle that bringing focus to problems and designing competitions will ignite incredible innovation and unprecedented collaboration toward practical solutions that attacks these global challenges at the core. We are pioneers of designing and launching this innovative prizes. We know firsthand from research and designing these competitions that value and benefits that arises from combining emerging technology and knowledge of the crowd is great. XPRIZE currently has 9 active prizes across many dish domains, including global learning, health, environments, sustainability, exploration. XPRIZE has seen how winning solutions in our competitions have capitalized on emerging technologies and advancement in AI combined with unprecedented amounts of data that's available out there.

What we hope to come out of this Summit are projects powered with AI solutions with long-term impact toward achieving the goals of United Nations 17 SDGs which were created originally to improve life and a way of living for humans in a sustainable manner in the coming generations.

The SDGs address many of the same global challenges that XPRIZE's competitions have worked on solving over the past several years. With many of the solutions taking advantage of AI. For example, the medical devices that were created for the XPRIZE which was awarded in 2017 used AI and collected data to diagnose acute and chronic diseases without aid of a professional healthcare provider. The global learning XPRIZE that's on going right now has teams using AI in providing learning solutions in software to enable children to learn basic education in remote parts of the world. Our shale ocean discovery XPRIZE has teams using AI to harness and use technologies to map uncharted deep ocean floors, completely autonomously.

The devices for a women safety XPRIZE triggers an emergency alert to a network of community responders with the use of AI. Our new west avatar XPRIZE has teams challenged to use AI for their creation of multipurpose avatar systems that will enable us to remotely see, hear and touch and interact with physical environments and humans through an integrated robotic device. Additionally, we have global lunar XPRIZE teams using AI to reach the moon. There's hardly a competition we have launched that teams have not used AI that solves these problems. Utilizing AI can lead us to revolutionary new approaches to solve these challenges. It was our own IBM Watson XPRIZE that truly let us get involved in this AI for good campaign. The IBM

Watson XPRIZE is a four-year competition to develop and demonstrate how humans can truly collaborate and integrate with the AI technologies. Each team is able to choose a global challenge, they're most passionate about, and create technology targeted towards solving it. Our goal is to accelerate adoption globally for AI technologies and to spark creativity and innovation, human AI collaboration.

We are super excited to see how these solutions benefit majority of the population, and we're also fully aware that these are unchartered territories and there is a possibility of unforeseen consequences. That is why we became a partner of this AI for good Summit in collaboration with ITU. To begin a multistakeholder dialogue, sistered around global risk assessment, best practices, and regulation and inspirational uses of new technologies, the AI for good movement brings together government, industries, academia, organizations like XPRIZE to establish partnerships, facilitate conversations and to conduct research that ultimately results in ethical, safe and beneficial uses of Artificial Intelligence. Our teams competing for the prizes are fully supporting these movements.

You can actually, please, tomorrow, make sure to go visit some of them. There is I believe six teams demonstrating the diverse solutions outside during the lunch break tomorrow.

As XPRIZE competitions increase utilization of AI in solving grand challenges, we're excited to continue working with AI for good in order to ensure that solutions we inspire remain in line with the guiding principles developed for the global Summit.

Thank you all for your participation and contribution to this dialogue over the next few days. Thank you.

>> PATRICIA BENOIT-GUYOT: Thank you.

As we draw to a close, I would like to take this opportunity to remind all of the participants at the Summit that during the next three days we're going to be using pigeonhole, an interactive Q&A app that will help facilitate in engaging in the panel sessions. I encourage you to all upload the pigeonhole gap as we're going to use this after this opening ceremony.

I ask you to leave the stage under a thunderous round of applause. Thank you.

It now remains for me to invite Reinhard Scholl and Amir Banifatemi to kick off the Summit. Thank you very much.

>> REINHARDSCHOLL: We're on? We're on. Good morning. Welcome.

>> AMIR BANIFATEMI: We're going to talk about using AI for the common good and the SDGs.

>> REINHARDSCHOLL: A show of hands of who was here at last

year's Summit? Okay. A bit. Quite a number it. Yeah. This is my favorite picture from last year's Summit. Can we do the same again this year, please.

So this is not some kind of formal United Nations meeting, this is an interactive meeting where we would like everyone to engage in.

>> This is organized in day one, two, three, today we'll have some initial introductions about framing the issues of the SDGs, some updates on how some agencies are using AI for good in different countries in different aspects and tomorrow we'll have four tracks, the four tracks will be divided in a way that you can participate, each of you, into projects that will be discussed and hopefully launched at the end of the Summit. Those four tracks will be announced tonight but in a nutshell the first one is about satellite imagery in AI, the second one, about using AI in healthcare and the third one, it is about smart cities and communities and the fourth one, it is called trust in AI. Track leaders will give you tonight an overview of what day 2 is about and will give you highlights. You will have to choose which track you will be participating in tomorrow and help frame some of the projects that have been already prebuilt or the project that you may come up with and during tomorrow you'll have a chance to make a difference and to share some of the projects to be announced on day three.

>> REINHARDSCHOLL: We covered a lot of ground last year but this year we're even more ambitious than last year. This year, we want to be more than a conference, we would like to come out with concrete projects. We would like you to have some skill in the game. We would like you to take ownership of a project, so ideally you come into this event with a project that may perhaps be 20% ready in your head, on paper, 40%, 60% and we hope that some magic will happen at this event that the project will mature even more and you feel brave enough to make an announcement. Ideally we would like someone among you to stand up and say I'm going to take ownership of this project, I'm going to do it and I'm going to come back next year and report what worked well and what didn't work.

>> AMIR BANIFATEMI: Last year we had 6 breakthroughs and talked on many topics but the focus of the top bic is to get the way to the action, to get to the action, problems have to be defined. To get to solutions that AI can be impactful, the first step, it is to define the problem. So your role, your mission if you accept it, it is to help shape those problems and define them clearly and hopefully when the problems are defined, the solution can be identified, the main next step, funding, it can happen. Funding is important and we try to find a way for the projects to get funded as well and to make the impact that

they're promising.

>> REINHARDSCHOLL: All tracks were curated by a team of volunteers. A lot of effort went into that. We thank all of those that input their time and effort into that. There is a lot of opportunity for networking. We have coffee breaks, we have lunch breaks, and every night we have a reception. We thank our sponsors that made that possible.

>> AMIR BANIFATEMI: We have a number of teams working on practical applications of AI in the lobby and you will get to see them every day, there is a special programme, a special showcase and demonstrations with robots as well out there.

We're very happy to have you all here. It is very exciting for us. We have been working almost a year to build the programme and this programme is project-based and the idea of the project is a novel approach. We hope that you will enjoy the design of the conference, and participate and make a difference. Again, a warm welcome to all of you. We're excited to have you and hopefully we have a collective experience in the next few days and come up with amazing proposals in day 3.

>> REINHARDSCHOLL: Enjoy.

Our next session is ran by Stephen Ibaraki. Stephen Ibaraki, I'll hand it over trait over to you.

>> STEPHEN IBARAKI: Thank you.

It gives me real pleasure to be here. It thank the Excellencies, AI for good global Summit, distinguished participants, all of our Delegates, I'm Stephen Ibaraki, the moderator of this keynote session with, sir, Roger Penrose. The topic is why algorithmic systems possess no understanding, it is controversial and a stimulating discussion. The keynote will be followed by a dialogue session with questions and answers between myself, the audience, also with Sir, Roger Penrose. Let's provide a brief introduction. He's an English mathematical fist assist, mathematician for loss of science, he's a professor of mathematics at the University of Oxford and a fellow. The professor is known for his work in mathematical physics and particularly his contributions to general relativity, and he's received numerous prizes for his decades of work, including the 1988 wolf prize for physics, which he shared with Stephen hawkings for the singularly theoroms.

I'll now ask you, professor, to take the stage, the podium, you can deliver the keynote.

>> ROGER PENROSE: I feel honored to present my point of view here to such a distinguished audience. It certainly is the case that Artificial Intelligence has advanced tremendously in the last years, and a question has been raised very often quite since the beginning of the subject which is whether and when -- if whether the subject of Artificial Intelligence will reach the

level of human intel with against. Now, I think it is very likely that it will reach the level of one particular part of the brain, namely the cerebelum, I make a distinction -- there are two parts of the brain in particular, one, the part where people usually refer to up here, and the cerebelum in the back, it is a bit underneath, the two, they have a comparable number of neurons each and the ce rebelum is have more connections than the cerebrum does, you may think that the cerebelum has more could you terrible power than the cerebrum and that's probably true. It is possible with the advance of Artificial Intelligence that one might reach the level of cerebelum activity.

I like to think of the relationship between the two, that's to say the cerebelum and cerebrum is a bit like the programmer and the action of the programme because -- you're driving a car, you're learning to he are verse, something like that, initially you have to work out, you know, if I move my arm in this particular way, so on, then the car will do such and such and you think through in a conscience way. After a while you don't have to think about it consciously. The cerebelum takes over. We know that when people play the piano, they play extraordinarily fast and accurately, they're not thinking about how they move each finger, that's all done unconsciously by the cerebelum likewise, a tennis player, the skills of the tennis player, they would not work out which muscle it should move at each stage. All of those things are controlled unconsciously and the unconscious actions are the kind of thing that one can well believe may well be something that you could imitate by some Artificial Intelligence system. When I say Artificial Intelligence, I mean, computer controlled in the sense that we now understand that term.

Why do I say there may be something different about the cerebrum. It really dated back to the early 1950s when I started doing research in cambridge on a completely different subject. It is a mathematical subject, algebra, geometry, didn't have anything to do with AI and such. I was very intrigued -- I have heard about the theorem that said apparently, so I thought, that there are things in mathematics that you just can't prove. I didn't like that idea. I went to this course on mathematical logic given by a man called stein, a very good course and I learned about touring machines and the theorem and he taught me -- and others in the class -- about this theorem and it didn't say what I was afraid of, that there are things you can't prove. What it said, if you have a system of proof procedures and these proof procedures are such that you could put them on a computer to check whether they have been accurately carried through then these procedures end up by

saying you feed in the theorem and at the end it says yes, proved, no,ish no, it is wrong, or don't know. Don't know, it doesn't say don't know, it just goes on forever. The thing is, what the theorem is, if you believe that the system never gives you the wrong answer, if you trust it, reason to believe it is right, you must believe a particular statement constructed from the rules must be true, yet unobtainable by means of the rules. I found this absolutely stunning when I heard that. It is not that you can't prove this thing, it is just that you have to use procedures which transcends the ones you're using. The key thing is, it is your belief that these procedures actually work.

If you're prepared to trust procedures when it says yes it is true, that it really is true, if you have enough belief in that, then you also believe the statement which goes beyond them. You somehow can transcend the rules. I thought it was amazing.

It sort of tells you that your understanding of why the rules work is more than using the rules. That's really what it does say.

What does that mean? Understanding, well, you look at the rules, you say yeah, I think that's okay, that one, I'm -- that's okay too. You go through that kind of reasoning, if you're convinced it is okay. Then not only do you trust using those rules but you can trust the procedure for jumping beyond the rules. This struck me as amazing. It is understanding transcend something the rules. This made me think our whatever it is that makes us understand things, and that seems to require a conscience perception of things, that's something that is not governed by rules. You're not quite so clear on that. It is rules that you know and can appreciate. Maybe there are rules in our head that are so complicated we can't know what they are, we don't know what they are. Something like that. I don't think that's the case. That troubled me and it troubles others who complain about what I write about. The thing is, you have to ask the question, how did we come about with our understanding of mathematics? We have a cartoon which I can't really show you here which shows our ancient ancestors doing wonderful things, building mammoth traps, building houses, domestic ating animals and there is a mathematician trying to prove something and a Tiger is ready to pounce on him. It is really to show that there is no particular selective advantage in being a mathematician. In fact, I think it is a disadvantage actually. Okay. General understanding, yes, that could easily be selected, it was, by natural selection. I'm okay with this. This can be applied in different areas. There is a nice example that I should show you but I won't show you here, you will be grateful for that. It is a theorem that's nice to give if you

have the time, it can be appreciated by people that don't know much mathematics. The thing about this theorem, you start with any number, when I say a number, I mean an actual number which means 0, 1, 2, 3, 4, whole numbers that are not negative.

If you take, we know about the procedure to prove a thing for -- one of the amazing things about understanding, it is that we can understand the infinite number of things. People say you can't understand infinity, can you read? Yes, you can. That's a thing you can do, a human being can do. A computer can't. That's really the point.

An example of how a human being may do this, we learn it at school. Suppose you have a proposition that depends on the number N. All you have to prove is two things. First of all, it is true for 0. Secondly, if it is true for N it is true for N plus 1, that's standard mathematical induction. It is true for all. The thing about this theorem, it can't prove it using that, it is a -- yet you can understand it. I'm not going to describe it. I'll give you a rough idea.

You are given a number, any natural number, and you apply to this two procedures, procedure A, and that is a way of getting this number, making it bigger. Procedure B, subtract more. A makes it bigger, B, subtract more, making it bigger, it makes it hugely bigger, absolutely hugely bigger. What's not obvious, it is that it is a tortoise and the hare, B always wins but it does it in so many steps you never would go through it. If you start with number 4, it goes through so many steps that no computer that's ever been conceived of could ever go through all of those steps. With a pencil and paper, you could see that by following the steps, oh, yeah, yeah, that's going to -- oh, I see it will come down.

What kind of reasoning tells you that? It is our understanding.

I think this shows that whatever understanding is, it is not something that you can incapsulate. I came to that view after hearing the talk. It was a bit worrying, what do we do? What is consciousness, what's understanding? Is it a magical thing that comes in our heads at some point and something like that? I don't like that idea at all. It seems to me that it must be something in the laws of physics because our brains are governed by the same physical laws as everything else. I don't think there is something else going on there. What are the laws of physics? This I took advantage of going to other courses one by one, you know, on quantum mechanics and I thought, well, you could put a thing about general activity on a computer, now we have the good Examples of this because people probably here have heard of the Ligo detection of black holes barreling into each other some galaxy millions and millions of light years away and

waves come along and a specific signal that you see from the waves, it can be seen in the gravitational detector. We have to pick this out of noise and stuff. How do we know that indicator is two black holes spiraling to one another, an extraordinary amount of computation. It is high powered -- I don't know about AI but direct computation of this particular problem. Really powerful stuff.

This shows the accuracy of this kind of comp takings. General relativity is something that you can really put on a computer and do it very, very precisely. How about quantum mechanics. That's a big evolution of the physics, and quantum mechanics, yes, you can put that in the equation, there are problems with it, you can put that in the computer, you can imagine how to stimulate the brain, whatever, put it on the computer and it chugs away and it solves the equation. Then there is a catch. Because this equation, it was clearly pointed out, it does not tell you what happened in the world. You probably heard about this, this idea was introduced to really show the absurdity of his own equation as applied to rather extreme situations. This is something that you put in a state that according to this equation, it is dead and alive at the same time. Look, this is ridiculous, he didn't quite say it like that, it was ridiculous, there must be something wrong with the equation.

He really did think there was something missing. Einstein did, and others did, even -- he wasn't quite clean on making the views clear. We thought the same kind of thing. The first lecture I went through, he illustrated this thing called the super position principle, which is used in this dead and alive at the same time, you see, you have in the quantum mechanics, the particle is here and here at the same time. That's a great thing to get your mind around. The theory works. The thing is, that's not the whole story because this equation says it doesn't allow it at the same time. That's not what you see. You see either dead or alive.

Something happens -- you have changed something down there -- excuse me.

Something happens that is not part of the equation. That's what you call making a multilinear and making the measurement in the device which is probably the device just like everything else, what's the difference. Any way, there was something happening which doesn't follow this equation. It makes a choice. The universe makes the choice between that and that.

You can make a criteria so combining the theories that I was talking about to say if you move so much mass into a super position of two locations how long does that live. You can work out a lifetime if you believe something to do with quantum

mechanics and generality together which is not part of the quantum mechanics, it does not say that one thing is part of the other and you wheel in another procedure and it is inconsistent. You get used to the idea when you use the quantum mechanics.

What is the other procedure? Nobody knows. It is the collapse of the way function or the reduction of the state.

For me, that was the gap. That's the one thing that you could not put on the computer.

In fact, I liked to call it this, I collaborated later and said I couldn't see how neurons could make use of this thing, but I was told about these things called micro tubials that inhabit all cells in the body, particularly neurons and these things which would shield information away from the outside world and use quantum mechanics in an essential way. I should make the point, people often say quantum mechanics is irrelevant to the brain action or something, of course it can't be true because chemistry is crucially quantum mechanics, you don't mean chemistry but something else, something beyond chemistry.

There is lots of that. We see that in quantum mechanics, they go beyond the ordinary procedures of chemistry. In the brain, it could be easily something like that, particularly in the micro tubials and I think that's likely correct, these are tiny tubes, nano scale and according to a colleague whose day job was to put people asleep reversibly as an anesthesiology and he's interested in what he's doing, his view is that the general anesthetics affect the micro tubials and it sends you to sleep in a reversible way. The thing is, the micro tubialses would be making this choice, and what's the choice? The choice is what we don't know about in nature. Nature just says it is random.

I don't think it is probably just random but something extremely subtle, something beyond comp takings, which is my view, the view would be that you can associate with every action of this state reduction process, collapse the process with an element of what we call pro toe consciousness. When pro toe consciousness, it is the building block out of which again went consciousness is built. We have to understand that part. Nature has made choices and they don't mean anything. In the brain, these choices do mean something. That is when we maybe make a conscience choice, it is a very interesting idea. A lot of people are skeptical of this kind of idea. It seems to me do we need somewhere that you take advantage of this part of the physical world as we understand physics, which goes beyond computational simulation and this is the place it has to lie on and that's the point of view we have taken and there are experiments that can shed good light on that.

Thank you very much.

>> ROGER PENROSE:

>> STEPHEN IBARAKI: I want to get a time check, we're ahead of time by the older schedule. Is there an updated schedule? I believe the tea time is 10:45? We're fine? Good.

This is the question and answer portion of our dialogue with the notable iconic legendary professor Roger Penrose, we're fortunate to have a man of his stature scientist of his statue across so many domains. I'll ask you for a bit of a favor, how many of you agree with my favor, show of hands? What! Come on! I just want to see who will agree with my favor. It is a simple favor.

They want the favor first. The favor is that we have a golden opportunity here with Sir Roger Penrose to make history, to make history to add to the history of the AI for good Summit. I want all of you to do a selfie later on during the session, not the end, I want you to stand up, face away from the stage, professor Roger Penrose will be here, I'll put a thumbs up, I'll be behind him, beside him, a thumbs up and I want you to capture a selfie of yourself and professor Roger Penrose and I want you to put it on social media. Let's make sure we have an impact on the world today courtesy of Dr. Roger Penrose.

I want you to check the time. Now let's see if I can get a show of hands on that favor. Will you do that favor for me and for AI for good and Dr. Roger Penrose? Better. I still don't see all of the hands up! Come on! That's good.

Now we'll get to the question and answer portion. As you know, we have this app where you can submit questions and I have some myself. I'll start the Q&A portion. I'll sit down.

Professor, you know, a very interesting kind of research you have done especially the latest work where you are indicating you have understanding and understanding -- the professor says it cannot be algorithmically determineddisticly done on a computer. It is something that transcends the computer. It is an interesting idea. As you heard the professor indicate, something more is going on, there is a quantum affect with the micro tubialses which is a structure in the brain that transcends what computers do. Using that as a context, the first question is, professor, what's right and wrong with the term Artificial Intelligence?

>> ROGER PENROSE: When I heard that term, I was nervous about the word intelligence. To me, there are three words one can consider here.

One, intelligence, one is understanding, one is -- let's see. Yeah. Awareness. Awareness.

Is this switched on or -- can you hear me.

Okay.

The thing is, intelligence, these are words that I wouldn't like to define any of them. It does seem to me that there are

implications between them. The word intelligence seems to me is something which requires understanding. That's to say if you have a device which you would call intelligent and it has no understanding, that's a misnomer. Whatever understanding is, it is an ingredient of intelligence. What about intelligence and awareness? Again, it seems to me inappropriate to say of a device, that it -- that it possesses understanding if there is no awareness. The usual usage of the words, it seems to me that we're taking the two together, intelligence requires consciousness. It causes awareness as to say.

It doesn't say AI isn't -- the devices are not intelligent. It does say that if they're not aware, they're not really intelligent in the normal use of the world. I didn't like the term intelligence. It seems to imply also the thing understands something. I think it is more likely the cerebellum, a device can achieve amazing things and the things it can achieve and I certainly agree with that, a great advantage, yes, tremendous. But they don't seem to know what they're doing. We, the person whose done the programming may know what they're doing. You can also point to systems like -- what do they call them -- the neural networks, where you set the thing so it improves the performance and you don't have the remotest on what it really is doing. The human being may not understand either. You understand the again principles under which it improves, so on. The understanding, it is something that we seem to present -- possess, present to the system as a whole. I'm just saying, never quite liked the word Artificial Intelligence, artificial cleverness would be okay. Artificial Intelligence implies it has qualities that intelligence has and I don't think artificial AI systems, I call it that, they actual do possess that. Of course, other people will probably disagree with me here. You just asked me my opinion. Yes.

>> STEPHEN IBARAKI: Maybe we shouldn't call it AI, right? We call it --

>> ROGER PENROSE: AC.

>> STEPHEN IBARAKI: Artificially clever. Maybe that's a bit of a conflict with AI researchers.

There's a question that's being posted by the audience, how do we incentivize young researchers to get involved towards programs like AI for good and focusing on these kinds of projects that are really motivated, motivating in many respects.

How do we incentivize --

>> ROGER PENROSE: The question is to me?

>> STEPHEN IBARAKI: Getting young people to focus on AI.

>> ROGER PENROSE: There is excitement in the subject anyway. I don't suppose that the excitement comes from people who want to think that they're simulating the cerebellum. I

think it comes from being able to construct devices, it comes from being able to construct devices which do amazing things. These amazing things, sure, there are lots of them, robots, which walk around, so on. Self-driving cars, what have you.

There is a huge amount of excitement in developing these devices. Maybe there is the hope that some people would have to try to build the device which could actually have conciousness. This raises a you will sorts of problems, ethical problems, goodness knows what. It is just as well that we don't have such devices yet. If they were conscience, you would have to worry about turning your computer off, you have to ask it, is is it all right for me to turn you off, you would have to say that each time. There is something that really has researched that. Do you really mean to. Yes.

I think -- it would raise questions that are nice to talk about. If you really believed it, it would be a really blockage to all sorts of developments in AI and we wouldn't want to send out something that destroys it if you really thought it was conscience. Sorry, I'm straying away from your question which is how do we excite young people. I would have thought there is an awful lot in AI, in what AI does that doesn't involve really being conscience or anything like that which is terribly exciting for young people. Whether it is games, whether it is trying to build robots which do wonderful things, so on. All I can say, I don't see any obstruction to that with the point of view that AI as we now know it, which is not involved, some new thing about physics, it is computers as we understand them, even whether they're quantum computers or classical ones, they still involve something beyond what we understand in physics as of yet.

Another question, professor, your colleague who you spent so many years working in collaborating with Stephen hawkings, what would he think about the current ideas on quantum affects causing consciousness in human begins?

>> ROGER PENROSE: We collaborated together on a project that you mentioned about singularlies and black holes and all of that, but after a while we started to diverge in our views. I think it was really that he -- although he initially when he put forward the idea of black hole evaporation it seemed had there was information lost and he put forth the idea that there should be information lost in black hole evaporation which I agree with. We agreed originally and he had his ideas on modifying the quantum mechanics and he changed his mind and said no, no, there has to be no change -- there can't be loss of information. You can't do this with quantum mechanics, to me, he was being too reactionary at that point. we departed. Remained friends, of course. We departed company as regards to what we believed

in. I'm sure he wouldn't like my ideas on AI because they suggest that you do need to go beyond standard quantum mechanics and say that standard quantum mechanics, they have no explanation for the reduction of the state.

He would say, well, maybe all of the different alternatives that exist forever, there are many worlds, all coexisting, so on. I don't go along with that view. We would have disagreed on that. You probably would have disagreed with me on my view about AI. I'm pretty sure he would. Yes.

>> STEPHEN IBARAKI: Next question from the audience, if we can get the questions up, again, this is for you, professor, right now machine learning is great at spotting patterns but it doesn't truly understand data. How do we transition to learning reasoning? That's the question. Machine learning, great at patterns but not truly understanding data. How do we transition to learning reasoning? That's for you.

>> ROGER PENROSE: I presumed it was the audience. Yes.

How do we -- that's good. The trouble is, I'm saying that it is not going to understand. You have to put your own understanding in it. The thing is, even -- this is striking, you -- you get the point, you see this is beyond the system we have had before. Then you say, okay, why don't we put that into the system? That's perfectly good. You go another step. You use your understanding to go to the next step and put that understanding into the system p you could keep doing that and although you say it never actually had the understanding, you can use the human understanding to improve the algorithmic system you had before and you can keep on doing that.

Maybe you could do that enough. You just -- the human provides the understanding and then if you're clever enough, you can see how that particular element of understanding can be translated into an algorithmic calculation. That's fine. I have nothing against that. I can see -- it could be hard in a particular case. Very often -- I made up this chess position, which you can use a bit of understanding, and you feed this to the chess programme Fritz which is the grand master level and it makes a stupid mistake and loses the game. You see why it loses the game, you can -- I expected it to lose the game, but the thing is, you then see what is the understanding that I was using that it didn't have and then you see how the programme is with the thing and it doesn't make that mistake again. I think you can see this in a positive light. Although it won't itself have the quality of understanding, if you can see clearly enough what this ingredient is in any particular case, and that particular instance of your understanding, you could make into algorithmic system and it goes beyond what you had before. It seems to me, as an optimistic statement. You are useful at some

point. human insights, so on, they have their relevance. When you can see how to incorporate that in a way which could enhance the could you terrible system, sure, that's fine.

-- enhance the computational system, that's fine.

>> STEPHEN IBARAKI: You have this work, quantum processes occurring in the human brains which gives us understanding which computers are incapable of, and that's what separates human understanding from algorithmic determine fistic processes that standard computers have. There is a gap. But at a base law of physics, what you are a talking about, the new ideas, interesting ideas about quantum processes. Could a computer ever do these kinds of quantum processes that you talk about that are unique in the human brain.

>> This is what we talk about computer, careful to say as we understand them today, a computer -- by the nature of the word, we say computer, that means it computes. It does what we understand in the ordinary sense. We have a good notion of that, it is a machine, what it can do, that's a had mod were computer, I should qualify that a bit. It means a had modern computer which never actually makes mistakes which is pretty close to what the truth is with them which never makes mistakes and which has an unlimited storage. That's not true. You can -- the storage may run on a certain point. the idea is that at that point you bring in more. So on.

It has a an unlimited storage which is not totally realistic.

It is, some of these problems mentioned, you would exceed the storage of any conceivable -- conceived I should actually say computer. So even though that is a deterministic thing that a human being can look at and see -- if you just plug that in the computer, it never would get there. Then, of course, you say, look, I have this understanding, I put that in, then it gets there. The point I'm raising here. We're talking about computers as we know them now. Now of course, I'm not saying that whatever is going on in the human brain is outside what you can build in the lab. There could be some day, some latter day Frankenstein constructing some device -- I'm not sure I like the idea -- some device that incorporates what I'm claiming is going on in this going beyond quantum mechanics as we understand it today. The elements would be brought into the action of this device, and then, of course, you have to worry about it, you have to -- you have to know what pain means, you will say if I do something to it, is it going to be painful to it. I'm glad we're not there. It raises ethical problems which we're not ready to face. Fortunately, computers as we now know them don't have consciousness and you can do what you like with them, you can kick them, throw them in the bin, turn them off, swear at

them, all of these things are fine. It doesn't feel a thing.

>> STEPHEN IBARAKI: Interesting idea, in fact, there is a question from the audience which is about the late and great Stephen hawkings was worried about our existence because of AI, and that ties into what you were saying, if something happens, maybe you want to comment on that question, the existence of AI, and worried about that aspect.

>> ROGER PENROSE: In my view, it would become a worry if we made these beyond computer devices which took advantage of this element of the physical world which I'm claiming is what consciousness is built from, if you like. The choices that the universe makes in the quantum system, it does this, does this, does that.

Nobody says you should make it, decide, what you should make it, as you like.

It is this decision that the universe makes, it is that it is somehow organized in a way in our brains which we make use of or which is us in a certain sense, but you could in principle according to this view have something in the lab which is not biological, with I is not human, which is not animal and which could perhaps take advantage of it.

Fortunately, I would say this is way in the future whether the human race survives enough to get there is a question I would say.

>> STEPHEN IBARAKI: In your 9th decade of contribution, amazing career in mathematics, relatively, philosophy, is there any -- this is the last question and then we'll do the selfie. Is there one final challenge or book or some quest that you still want to do over already an amazing career?

>> ROGER PENROSE: Oh, yes! There is something in -- that's exciting too, but that's not got so much to do with this discussion. All right. What else. We have both of you writing, I was supposed to write this book for at least a decade. A book which takes the works -- amazing works, and develops various themes of mathmatic, I think of themes that could be explained in simple terms using these explanations and I really want to get down to this Bock but I have been distracted by too many other things.

>> ROGER PENROSE: This is not a distraction, to share with leaders of the world, really on this idea of a common good, we're now going to execute on my favor. As many of you can, I want you to stand up, turn around, hold the camera up, we'll get professor hawkings -- professor hawkings?

>> I'll put. Mic down. You won't get to hear me.

>> I stand up too I guess. I'll grab the --

>> Okay.

>> Are you able to do this.

We have the thumbs up. Remember, you're going to socialize this through social media.

Quite honored. Thank you. Thumbs up. That's great. Not yet. Wait until we're finished. .

You can all say that now you have done a selfie with Sir Roger Penrose. How many people can say that! A thunderous applause for the professor. Thank you. I guess there's a break coming up.

That was fun by the way. Thank you for agreeing to my favor.

>> We have a coffee break now and we have the first demo outside. We have a break.