

News & Highlights

Transformational Technology Takes Center Stage: Global Grand Challenges Summit 2019, Day One



Sean O'Neill

Senior Technology Writer

With artificial intelligence (AI) systems now able to match the diagnostic abilities of seasoned doctors for certain ailments, and even suggest treatment options that no one had thought of, it is clear that AI and data science have the potential to transform aspects of healthcare for the better [1,2]. Move beyond medicine, however, and things quickly get murkier: All over the world, the growing adoption of AI and other transformative technologies is raising countless societal, industrial, ethical, and environmental challenges.

Day one of the Global Grand Challenges Summit (GGSC) 2019, which ran from 16 to 18 September in London, explored these conundrums, asking if such technologies will change humanity for the better [3] (for more background on the GGCS series of meetings, see the news story in the previous issue of *Engineering* [4]). The day revolved around four panel-based sessions, each about an hour-long, including brief presentations from each of the panelists, followed by a Question & Answer session with the audience [5]. The panels contained a mix of entrepreneurs, engineers, academics, and innovators (Fig. 1).

The first session centered on how AI would affect the world of work and was moderated by the CEO of the Royal Academy of Engineering, Dr. Hayaatun Sillem (Fig. 2). A theme that quickly emerged was the growing, AI-fuelled disruption of the jobs market—the balance between job creation and displacement; the “winners and losers” [6].

The “AI skills gap” was a related concern [7]. As Professor Juergen Maier, CEO of Siemens UK, put it: “We do need to look for a very different approach towards lifelong learning and educating, and bringing people on the journey with us.” Sillem agreed, saying that the UK needs to “recalibrate the way we are doing education to address these really profound changes.” There needs to be more focus, Sillem said, “on humans upgrading their ‘software’ more often.”

The second session dealt with “ethical AI,” asking the question: “What does ‘good’ digital technology look like?” It was moderated by Luciano Floridi, professor of Philosophy and Ethics of Information at the University of Oxford, and the director of the Oxford Internet Institute’s Digital Ethics Lab. This discussion ranged from the establishment of internationally agreed ethical principles to govern the development of AI [8], to the importance of fostering diversity of personnel working in AI and data science.



Fig. 1. How can businesses take advantage of AI and other data-driven technologies, while also addressing social needs? Discussing this were (left to right): Dr. Zhonghan (John) Deng, co-founder and chief scientist, Vimicro Corporation, Beijing, China; Chris Benson, principal AI strategist, Lockheed Martin, Atlanta, GA, USA; Diane Greene, co-founder of VMware, Palo Alto, CA, USA, and former CEO of Google Cloud; William Tunstall-Pedoe, technology entrepreneur, London, UK; Juergen Maier, CEO, Siemens, Frimley, UK; Dr. Hayaatun Sillem, CEO, Royal Academy of Engineering, London, UK. Credit: Rob Lacey, with permission.

Speaking after the conference, Floridi said: “This coming together was a moment of nourishing and fostering of internal awareness about the crucial importance of engineering, in a world that has always depended on engineers but even more so today. Too often, I find the debates we are having around AI to be unanchored—especially on the socio-ethical side, or with regard to legal implications and challenges. There is a grounding in real science, real technology, real solutions that only the engineering profession can truly bring to the table.”

The third session of the day focused on “transformative technology,” and how it will change our world, from the domestic—such as Toyota Research Institute’s home-help robots learning to place crockery in a dishwasher—to the futuristic—humans living en masse in space.

Professor Jackie Hunter, chief executive of Clinical Programmes and Strategic Partnerships at London-based BenevolentAI,



Fig. 2. In the face of the transformative effects of AI across industry, the CEO of the Royal Academy of Engineering, Dr. Hayaatun Sillem, advocated for a “recalibration” in the United Kingdom’s approach to education. Credit: Rob Lacey, with permission.

a company pioneering the application of AI to medicine, told the audience (Fig. 3) how her company’s machine learning systems can automatically ingest a vast array of biomedical data—millions of published research documents—read them and extract meaningful data, building an enormous “knowledge graph” of systems biology across numerous diseases. This knowledge graph can then be explored for previously unknown relationships between diseases and medicines. One of the aims is to make new drug discovery significantly more efficient [9].

Hunter also described the collaboration between the AI pioneers at DeepMind and Moorfields Eye Hospital, also based in London, wherein a machine-learning system was developed that can examine eye scans and suggest the correct referral decision for dozens of eye conditions with the accuracy of top human experts.

“Events such as the GGCS are important because they are helping to inspire the next generation to use new technologies to solve some of the world’s most pressing challenges,” said Hunter. “The relationship between data scientists, engineers, biologists, chemists, and

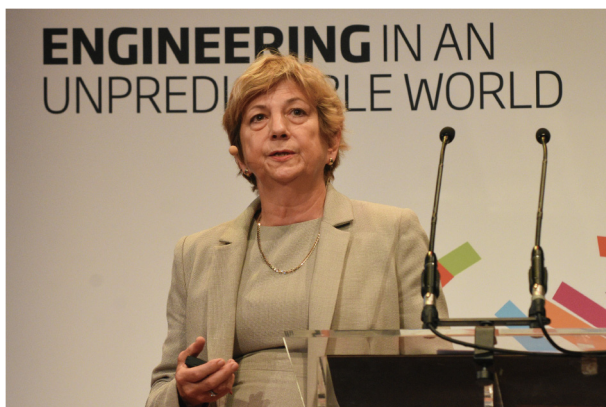


Fig. 3. Professor Jackie Hunter of the London-based company BenevolentAI spoke about the power of AI to innovate in healthcare and accelerate new drug discovery. Credit: Rob Lacey, with permission.

clinicians is going to evolve significantly over the next decade to enable the impact of AI and machine learning to be truly realized.”

In considering the programming of the day, Dr. John Lazar CBE, chair of the GGCS 2019 Steering Committee, said that he was pleased with the juxtapositions in the programming: “We had, for example, an interesting speech by Rob Meyerson on space, but what I pushed to do was then to have the next session look at the transformational impact of engineering innovation by showcasing some of our winners of the Africa Prize and other RAE awards in the developing world.”

Meyerson is a space engineer and former CEO of Blue Origin, an American spaceflight services company based in Kent, WA, USA. Blue Origin develops rocket-powered vertical take-off and vertical landing (VTVL) vehicles. “I believe launch vehicle reusability is the most important and most transformational technology in space flight in the last 50 years,” said Meyerson. “Reusability is reshaping the way we access space by lowering costs.” He also advocated capitalizing on space resources—making propellant and building structures in space—and argued that engineers should “revisit” nuclear propulsion for spacecraft, to minimise journey times to distant bodies.

Back down to earth, the final session of the day featured alumni of the Africa Prize for Engineering and Innovation [10]. The prize awards commercialization support to innovators in Africa who are producing scalable engineering solutions to pressing local challenges. Four alumni were given the opportunity tell the story of how their products, and their entrepreneurial journey, took shape. Products included a chick-brooding setup, invented by panellist Evangelista Chekera, the founder of Passion Poultry in Zimbabwe. The setup was designed to emancipate the many children on family small holdings from the important but onerous task of protecting new-born chicks.

Another innovation—discussed by its co-inventor Brian Turyabagye, chief data scientist at MamaOpe (“Mother’s Hope”) Medicals in Uganda (Fig. 4)—is a smart jacket designed to accurately diagnose pneumonia in children. According to United Nations International Children’s Emergency Fund (UNICEF), the condition kills over 800 000 children under five every year, and



Fig. 4. Brian Turyabagye of MamaOpe Medicals in Uganda talked about his company’s smart jacket for diagnosing pneumonia in children, and also the importance of supporting innovators and engineers across Africa. Credit: Rob Lacey, with permission.

in 2016 about 14 500 of those children were in Uganda, where access to doctors' expertise is limited [11]. The MamaOpe smart jacket is currently undergoing clinical trials. "There are many untapped opportunities in the native challenges that Africa faces, and most of these challenges cannot be simply solved using what has worked elsewhere," said Turyabagye. "The Summit is a chance for the world to learn of the stories and ground-breaking solutions coming out of the continent."

"As we reached the end of the first day of the Summit, overall I was pleased with the how the agenda worked," said Lazar. "The programme allowed us to hear from a wide range of speakers, from young engineers starting their journeys, through engineering leaders with broad and expansive visions, to entrepreneurs tackling pressing problems."

"The theme that resonated most strongly with me," said Sillem, "was the real focus throughout on putting humanity at the center of our engineering practice as a necessary first step in facing up to our challenges. Linked to that, there was a strong reframing of engineering as a set of habits of mind and ways of thinking that can be used to conceptualise and act on global challenges."

In the next issue of *Engineering*, we will report on the final day of GGCS 2019, which was built around the theme: "Can we sustain 10 billion people?"

References

- [1] De Fauw J, Ledsam JR, Romera-Paredes B, Nikolov S, Tomasev N, Blackwell S, et al. Clinically applicable deep learning for diagnosis and referral in retinal disease. *Nat Med* 2018;24(9):1342–50.
- [2] Duffy L. Finding the needle in the haystack—how artificial intelligence is speeding up drug discovery [Internet]. Medium; 2019 Sep 23 [cited 2019 Dec 6]. Available from: <https://medium.com/parkinsons-uk/finding-the-needle-in-the-haystack-how-artificial-intelligence-is-speeding-up-drug-discovery-4dbd1a13dfd8>.
- [3] Global Grand Challenges Summit 2019: engineering in an unpredictable world [Internet]. London: Royal Academy of Engineering; 2019 Sep [cited 2019 Nov 25]. Available from: <https://www.raeng.org.uk/publications/other/ggcs-2019-brochure>.
- [4] O'Neill S. Global Grand Challenges Summit 2019: engineers come together to tackle an unpredictable world. *Engineering* 2020;6(2):102–4.
- [5] Global Grand Challenges Summit 2019: Day 1 sessions (video recordings) [Internet]. London: Royal Academy of Engineering; [cited 2019 Nov 25]. Available from: <https://www.raeng.org.uk/policy/partnerships/international-policy-and-development/ggcs/2019/welcome/on-demand>.
- [6] Perisic I. How artificial intelligence is shaking up the job market [Internet]. Geneva: World Economic Forum; 2018 Sep 17 [cited 2019 Nov 25]. Available from: <https://www.weforum.org/agenda/2018/09/artificial-intelligence-shaking-up-job-market/>.
- [7] The future of jobs report 2018 [Internet]. Centre for the New Economy and Society, World Economic Forum; [cited 2019 Nov 25]. Available from: http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf.
- [8] Floridi L, Cowls J. A unified framework of five principles for AI in society. *Harv Data Sci Rev* 2019;1(1).
- [9] Butcher M. BenevolentAI starts AI collaboration with AstraZeneca to accelerate drug discovery [Internet]. San Francisco: TechCrunch; 2019 May 1 [cited 2019 Nov 25]. Available from: <https://techcrunch.com/2019/05/01/benevolentai-starts-ai-collaboration-with-astrazeneca-to-accelerate-drug-discovery/>.
- [10] The Africa Prize for Engineering Innovation [Internet]. London: Royal Academy of Engineering; [cited 2019 Dec 6]. Available from: <https://www.raeng.org.uk/grants-and-prizes/grants/international-research-and-collaborations/africa-prize>.
- [11] Estimates of child cause of death, acute respiratory infection 2018 [Internet]. New York: UNICEF; [updated 2018 Feb; cited 2019 Nov 26]. Available from: https://data.unicef.org/wp-content/uploads/2018/02/CoD_ARI_Feb-2018_WHO_MCEE_236.xlsx.