Vision, needs and requirements for Future Research Environments: An Exploration with Computer Engineer and Science Fiction Author Cixin Liu

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We live in remarkable times: the world is changing at an increasing pace, our societies face challenges that extend across national and geographical borders, and we are flooded with (dis)information. The scientific process has already changed extraordinarily in the past half century with research environments evolving from isolated and loosely connected islands to dense networks of researcher and institutional cooperation.

Still the world is changing and we need to ensure that science remains a global effort. Building a global network and infrastructures to support that aim, however, takes time. We need to start such building processes now and – most importantly – we need to develop and explore visions for research, science and society that give us ways into desirable futures. Thus, we launched an exploration series to elaborate visions on how research will be conducted in the future and to explore different perspectives on research.

"We overestimate the collaborations we are able to achieve"

TU Wien: Thank you so much for joining our exploration series. I would like to start with a topic that is very prominent in the *Remembrance of Earth's Past* series. You introduce cosmological sociology as an essential topic to study and – by doing so – put the focus on questions of operation, competition and trust. In a non-fictitious setting, we see similar questions arise in our interaction with complex systems and AIs that we will need to be able to trust. How can we establish a basis of trust?

CL: I am a Science Fiction author as much as I am a computer engineer. Therefore, I will answer any questions from that perspective. In the early days of the technology, computers and AI, we understood the reasoning of computer programs from the beginning to the end. With the development of AIs and information technologies, the reasoning as well as the computational processes of AIs became very complex. We are beyond tracking each step of its computation and we cannot comprehend the reasoning processes anymore, which is to some extent why we tend to call AIs intelligent. If we did understand the processes, we would not call them intelligent. This, however, created trust issues because we fail to understand how AIs get to their results.

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TU Wien: We tend to trust humans, even though we do not understand how humans work internally. Why would we need a deeper understanding of how AIs function before we are able to trust them?

CL: We base trust on intellectual equality. Although we cannot explain each decision, or motivation of others, we can at least understand their reasoning processes. Establishing trust would be very difficult for beings with completely different ways of thinking. The way machines "think" differ from ours. At their current state, it is not yet a trust issue but the further we fall apart in terms of "intelligence", the harder it will get to trust the results of AIs. In addition, it is difficult to constrain and control AIs. Their development may well come with dangers that we are not expecting.

TU Wien: Do you see the need for, or even the possibility to monitor and control the advancement and development of AI research?

CL: I think we should set at least some limits in connection with the development of AIs including the physical limitations on hardware and software. If we want to use AIs in practice, however, we have to face the fact that we will have less power over it. For example, if we want to use a super AI in the real world, you must connect it with the internet, with the necessity of loosening some constraints, at the same time. Eventually we would lose control. How to make use of AIs and guarantee safety is something we need to balance.

TU Wien: How well do you think are we prepared to address or face such challenges – as the human species, as one world?

CL: Uniting humankind on a global scale in order to face challenges together is a difficult goal to reach, even though it would be desirable. From the COVID-19 pandemic, we could see that we overestimate the collaborations we are able to achieve. We have to face this reality. I am, however, optimistic for the future of humankind. Regardless of how divided we are, the new technologies and trends in development are connecting us as a whole. I believe in the future, humans will unite and face challenges, crises and even disasters together because it will be the only way to preserve the human species and their civilizations. I therefore think we should focus on progress in science and technology as it can guarantee a bright future for humankind. Of course, many other things might help as well, but the most fundamental one is technology.

TU Wien: I think this is an excellent point considering the role of science in decision making in different countries. However, we would need to find better ways to communicate science to society in order to make such messages heard and understood.

> "Scientists and institutions should take the responsibilities to support and increase people's understanding of research and science"

CL: I agree. Nowadays citizens seem to be moving further and further away from research and cutting-edge science. It is because modern science is becoming very complicated and highly complex, which makes it hard to understand for societies because their understanding of science is that of what we learned back in school. Scientists and institutions should take the responsibilities to support and increase people's understanding of research and science. Otherwise, there might be severe consequences

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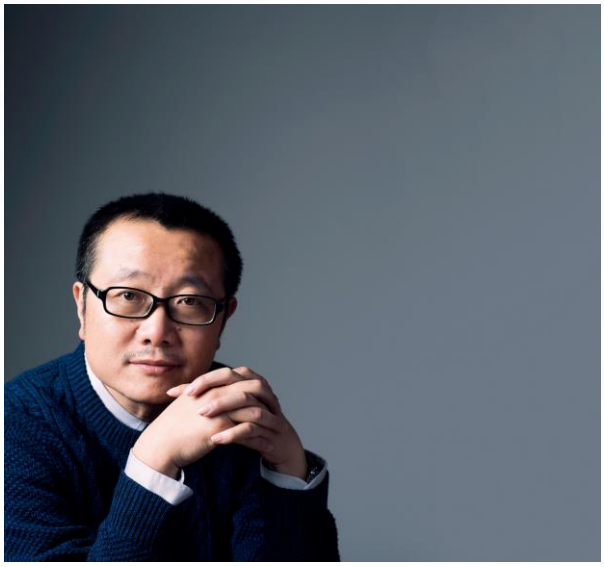
in the future. Additionally, there is a trend in academia to propagate and exaggerate the negative sides of science and technology, rather than communicating to the public that science and technology are fundamental for our survival. This is very regrettable.

TU Wien: What would we have to do then?

CL: That is hard to answer. First, scientists should take responsibility. I really admire Sir Roger Penrose, the Nobel laureate in Physics 2020. He is the author of *The Emperor's New Mind* and he is passionate about propagating science to the public. Nevertheless, we are currently not doing enough. We should not teach detailed knowledge of science, but we should ensure that the public knows enough to relate to scientific reasoning as well as the spirits of science. I think it is very important.



Credits: Portrait by Li Xiaoliang

Cixin Liu studied at the North China University of Water Conservancy and Electric Power in China, and is most reknown for the Remembrance of Earth's Past-*Series. Liu won several awards for his work, including the* Galaxy Awards *and the* Hugo Award.

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