**'Universities 4.0: grand challenges in
a digital society'**
Address on the 177th Dies Natalis
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One hundred and seventy seven: despite its venerable age, our university is abundantly full of life, and so a birthday should be a time to look forward, to our future. We do that with our mission in mind, which is: *impact for a better society*. As you must have heard me say before: we should not only be good at what we do, but what we do should be good for something.

We can achieve that by aligning our research and education to global challenges as expressed in the UN Sustainable Development Goals – a framework for solving some of the most persistent grand challenges that exist today. Or, as the UN describes it: 'a blueprint for peace and prosperity for people and the planet, now and into the future.' This blueprint covers a lot of challenges that we are already working on, like clean water and sanitation, renewable energy, smart cities, and sustainable development.

Challenges where technology will play a crucial role. Take health care: Over the coming decades, both medical research and clinical practice are increasingly expected to go hand in hand with developments in the engineering sciences.

By combining fundamental principles from physics with sophisticated mathematical models, we are gaining fascinating new insights into the physical processes that take place in cells and tissues. That will help us to understand things like the onset of disease, or indeed bring us closer to the origins of life. Through analysing medical and genomic data we can obtain indicators for disease, and use these to prevent disease or to develop treatments tailored to individual patients. And technologies like CRISPR gene editing are set to bring monumental changes to healthcare that we are only seeing the beginning of.

The health care transition is just one of the transitions currently in progress. The advent of Artificial Intelligence is going to affect our lives in many ways. Smart mobility will forever change the way we get around. Electric, autonomous and shared vehicles will make transport cleaner, safer, and more efficient. Or, as one expert describes it: Zero Emissions, Zero Accidents, Zero Ownership.

Precision agriculture will greatly improve crop yield: with technologies like remote sensing that can estimate the amount of water in the soil, or plants equipped with sensors that can report back their condition through an Internet of Plants. Education will change profoundly too, with AI instructors that can gauge the performance of students and adapt instruction materials accordingly in order to maximise students' learning experience.

In fact, robots will outperform humans in most fields. In time they will not only be better teachers, they can also work in darker and more hostile environments than a technical university, they are tireless and fearless, and won't complain about the quality of coffee. They will probably be better administrators, too, and even a more attentive audience. So I predict that by the time we celebrate our bicentennial, a robot rector will be doing the talking here, facing a robot audience.

All positive outcomes, except perhaps for that last one.

Or are they?

As we know, all new technologies come with risks and consequences. Some can be unintended, rebound effects: autonomous cars may lead to more cars, instead of less, as people without a driving license will now want to own a car. Others can profoundly impact our lives. When robots have efficiently taken over the majority of our jobs, how will we fill our time meaningfully? I know for many of us here today, our work is an important part of our life, even our identity. So let's just imagine that for a second…

But what if our highly personalised medical treatments become so expensive only the very rich can afford them, leading to more inequality, instead of less. And hat about gene editing technology, do we really want to rewrite the book of life? Or what if, ultimately, our lives are digitised and automated to such an extent people become collections of data, with society being its information processing machine? We wouldn't have to worry about privacy or cybersecurity anymore: they'd be non-existent.

As universities, and in particular as universities of technology, we are at the forefront of these developments: we are the drivers of change, but we are also undergoing the same transition. That will not only influence the subjects we teach and research, but also the way we teach, perform our research, and communicate. What is the added value of our teaching when we can have teaching machines? Do we still need bachelor and master degrees in the future anyway?

Such questions strike at the heart of what universities are. If we are to remain relevant as an institution, and continue to have impact, we will have to adapt. We should become universities 4.0.: modern institutes of learning that offer education in various modes, leading to a variety of degrees, qualifications and credentials, that can support people throughout their working life. Meanwhile, our physical campuses will more and more turn into locations for entrepreneurship and collaboration, where industry and academe work hand in hand to solve societal challenges.

This does not mean we should throw all our traditional roles overboard, on the contrary. Traditionally, universities are keepers of knowledge and, as we have seen, we are also drivers of change. In addition, we should be more than ever vigilant about the outcomes of our research. Let us never lose sight of the wisdom that everything that is technically possible and economically advantageous is not automatically desirable from a human standpoint. We should, in other words, also be the guardians of values.

Drivers of change, keepers of knowledge, guardians of values.

In this respect we have one very urgent task: we have to work on improving our connection to society, and reach out more to the general public. Public trust is deteriorating: fake news is on the rise, and many people value their personal perceptions over what we consider to be irrefutable facts. For example, figures from the World Health Organization show that in the first half of 2018, more than 41 000 children and adults across Europe were infected with measles, and at least 37 people died.

Unfortunately, this is bound to get worse, before it gets better. Leading business analyst firm Gartner predicted last year that by 2020 consumers will be exposed to false content more often than not. For the foreseeable future, AI systems will be able to create fake content faster than fraudulent digital information can be detected. A sobering thought.

However, there is a definite ray of hope on the horizon: never before in history have there been more Dutch engineers – many of them from TU Delft of course, neither have there even been more TU Delft students. With all that innovation potential, we should be able to make a difference.

With that in mind, let us now move on to our theme of the day: Climate action. Climate change is of course one of those grand challenges facing us. Here too, the amount of fake news seems to rapidly outpace the facts. And, as we have seen in recent weeks, with public 'debate' taking place on social media, scientific arguments are more and more greeted with slanging matches... It takes a brave scientist to face that. Unfortunately, the real news could have been better, too. The IPCC has concluded that the Paris agreements are not enough to limit global warming. And the recent COP24 at Katowice, that was supposed to deliver the Paris goals, could also have gone better. In short, time is pressing.