

Official Opening of the 2017-2018 Academic Year

Inspiring research

Robbert Dijkgraaf

Dear guests,

This is the best time for science. Never before in history have we known or understood so little. Never before have there been so many questions and challenges and so much talent and technology available to address these.

Simply put, we can characterise the science of the previous century as the search for the building blocks of reality. The molecules, atoms and elementary particles out of which all matter is made. The cells, proteins and genes that make life possible. The bits, algorithms and networks that form the foundation of information and intelligence, human and artificial. But now we find ourselves in the next phase. This century will explore all there is to be made with these building blocks. The collection of Lego bricks is complete; now we can start to play. From discovering to designing.

In 14 billion years of cosmic history and almost 4 billion years of life on earth, nature has explored only the tiniest fraction of all of the possible building designs. Evolution is a slow player. As biologist Richard Dawkins likes to argue, we humans – along with every other organism that has ever lived – enjoy tremendous privilege; the winners of a lottery with virtually no winners at all. Writing out the zeroes in the total number of possible DNA combinations alone requires a series of thousands of hefty volumes. From that mind-boggling number of alternatives, our genetic codes were chosen to be realised. The same goes for all forms of matter around us and every thought that we have ever had. It is only the tip of an endless iceberg of possibilities.

All of this is changing. The agonisingly slow natural discovery process is now occurring at an accelerated pace in the Planet Earth Laboratory. Together with powerful, self-learning computers, soon to be based on quantum theory, we will be mapping this new world both practically and virtually. We will shortly be able to order every item on the reality menu. This Brave New World with new 'artificial' materials, organisms, brains and perhaps even a better version of ourselves, appeals to us and at the same time alarms us. Not least because the pace of these changes continues to increase, perhaps too quickly. The ship of progress is leaving the inland waterways and is now headed for the open seas, filled with crashing waves. This raises fundamental questions about how we will use science to shape our society in the future. What is our technical and moral compass in this endless sea of

possibilities? Where do we find the necessary radical ideas, the transformative technologies, the complementary approaches, the reflection and ethical considerations? Where are the individuals who look further and think more deeply in order to set the appropriate course? I am hoping it is the university.

We are living in an age of unlimited technological possibilities. In the meantime, the world is busily searching for new sources of economic growth whilst grappling with serious ecological and social challenges. This field of tension between supply and demand is exactly where science must have the courage to listen to its inner voice. It is difficult, if not impossible, for politicians and citizens to see the future. The customer cannot always be right. It is hard to know what you do not know.

The genius of Steve Jobs was that he was able to come up with products that no one had missed, yet everyone seemed to need. Ten years ago, there was no insatiable demand for iPhones. When the first computer was developed, Thomas Watson, the president of IBM, said that there was a world market for about five computers. Granted, in those days they were as big as a house and constantly breaking down. During a party back in 1991, when I described the world wide web with internet pages that you could click on, people just shook their head: just another physicist's hobby taken to the extreme.

Bottom-up initiatives led by visionary researchers have the greatest chance of forcing the breakthroughs that society so desperately needs. Even though the same society may not be aware of it. Fifty years ago, no one could have recognised the need for gene therapy or Google's algorithms. Nearly every useful application originates from the investigations conducted by free minds, motivated solely by their passion for learning to understand something about the world. Interestingly enough, it often tends to be artists and writers, from Jules Verne to H.G. Wells, who are the first to imagine the future, unhindered by common sense or technical expertise. Peripheral vision, on the outermost edge of the field of vision, looks furthest ahead.

In order to let science be as useful as possible, it benefits from less emphasis on concrete results and more attention to the process and the motives: imagination and curiosity. Imagination lets us dream about what is beyond the horizon. Curiosity is the will to travel towards that horizon, all alone and in a rickety boat if needs be. An inquiring attitude – the open mind that challenges the familiar, the courage to try something new and also to accept failures, the calm to carefully analyse results, and the vision to set the course – is essential not only in science. Education, the corporate sector, the arts and yes, politics too, deserve to be allowed to dream about what they do not yet know, about a world that does not exist but could materialise. Like Robert Kennedy said: *'There are those who look at things the way they are, and ask why ... I dream of things that never were, and ask why not?'*

There is nothing wrong with strategic planning, social challenges, national agendas, top sectors, key technologies and other top-down control mechanisms. The problem, however, is that the results are always the same. The research priorities of many a university, region or country look exactly alike. The danger is more of the same, a regression to the average, a pile-up in the safe centre. The quantitative metrics, evaluations and protocols employed by research backers – all with the best intentions, it should be said – lead to risk-averse behaviour. Bruce Alberts, the former president of the US National Academy of Sciences, wrote in *Nature* that the current hyper-competitive atmosphere smothers creativity and encourages scientists to conduct average, safe and uninteresting work. ‘We must reward people who do something different.’

You are probably familiar with the story of the creativity test that the American space organisation NASA developed to select the best engineers. Only two percent of the candidates passed this difficult test. Then someone had the bright idea to give the same test to five-year-olds. Suddenly, the pass rate was 98 percent. For the age of 10 it dropped to 30 percent, and for fifteen-year-olds it was only 12 percent. No one wants to board a rocket designed by five-year-olds, obviously, but the results speak volumes nonetheless. Our upbringing and education stifle imagination. The researcher button is switched on in every child by nature. The job is to not switch it off. I am certain that future generations will look back on this age in disbelief at how actively we managed to curb creativity and the urge to discover.

The natural raw materials currently being exhausted across the world most quickly feed the mind – not the stomach or the combustion engine. Free time and free space, the chance to freely explore the world, these are becoming increasingly scarce resources. It would be nice if economists could determine the value of an hour of thinking time. Biodiversity is similarly in strong decline; not only the beetles and frogs in the rainforest, but also the unruly thoughts and dreams in our mind. Universities need to be the hatcheries, the orchid hothouses, where fragile ideas and nonconformist thinkers can flourish in security. The problem with the age-old Dutch meadow adage is not only that the whole field is cut to the exact same height – mowing down those who figuratively rise above it – but also that it is grass only. This day and age calls for untilled soil where myriad wild flowers can bloom in abundance.

As a society, we must encourage the individuality and quirkiness of researchers and institutes alike. We must dare to make a difference, dare to choose. The same goes for a university as applies to everyone in life: there are many things you can do, but there are only a few things that only you can do.

The biggest capital is formed by the researchers themselves. The secret ingredient of leading universities is not unlimited means, it is unlimited talent. That is the strongest magnet for other talent. And let us make one thing clear in these xenophobic times where shutting down borders is considered the solution to all of the evils of the world: in science, globalisation works. Throughout the ages, the free movement of people and ideas has yielded only profit. The elimination of intellectual barriers creates a win-win situation for humankind. Universities must firmly defend this freedom.

We are accustomed to thinking in terms of our background. The family or town we grew up in, the values instilled in us, these determine the course of our life. But the beauty of science is simply that it is a destination. A place where people from all over the world converge, drawn by a magical force. Scientists are like migratory birds that instinctively know where their breeding grounds lie. There is nothing finer than students or researchers who – after a long journey, be it intellectual or physical – meet their equals and experience a sense of finally coming home to roost.

Although money cannot be the most powerful magnet, it is crucial for making research possible. Science is often accused of never being satisfied, always wanting more. But this is not spoiled adolescent behaviour. It is simply logic speaking. All economic calculations show that scientific research is an excellent investment in society. According to a recent European Commission report, a 10 percent increase in R&D spending results in a productivity increase from 1.1 to 1.4 percent. In other words, if we would spend an additional 0.2 percent of our gross national product on research, that same GNP would grow by at least 1.1 percent. That exceeds a fivefold yield. Imagine that you could multiply your capital by five: surely you would stake all your money on it! For the Netherlands, this calculation means that an extra billion euros for science, a perfectly reasonable demand, ultimately generates six to nine billion in economic growth. That sounds too good to be true. Perhaps that explains why politicians are afraid to apply this logic, too familiar as they are with a world filled with advertising claims and half-truths.

That extra billion would signal the first step in the right direction towards a far less ambitious goal: bringing the Netherlands up to the European or world average. After all, when you have no idea of what to do, the first rule is to copy others. Incidentally, the same goes for the division regarding scientific domains. I have never understood why successful fields such as physics and chemistry, which earn a large share of the awards, in a brief span of time have dropped below the world average by as much as 60 percent in terms of their funding in the Netherlands. It has been said many times before: our country prefers VIP seating without paying the price. The problem is that when they do check your tickets, you end up in the stalls anyway.

Dear guests,

Although it is the best time for science, it is also the worst. Scientific thought is under pressure everywhere around the world. I experience this every day on the other side of the Atlantic Ocean, where the new government has no qualms about reversing legislation on climate and the environment, making Draconian cuts to research budgets and closing the borders to knowledge immigrants. We are seeing attacks on rationality and the fruits of science not just in the United States but all over the world. There is a surge of fake news and alternative facts, and suddenly many feel free to deny the validity of climate studies, vaccinations, evolution theory and even basic logic.

Following the election of Donald Trump as the president of the United States, a commentator said that part of the electorate felt that the country was gravely ill and should be prepared to take an experimental drug. We are now living with the side effects of that treatment. Perhaps people should have read the patient information leaflet more carefully. The new regime is a serious attack on the national immune system.

Fortunately, we are also seeing the immune system at work. Many institutions have been inspired to adopt a defensive role: the serious press, political parties, international organisations, NGOs and yes, universities too. Perhaps this stress test for the Enlightenment is the wake-up call that the world seems to periodically require. After all, in the wake of an infection, the immune system generates a reservoir of antibodies that can help prevent a future infection.

In any case, this is not the time for the university to sit back and keep quiet. Universities should indeed play a pivotal role in this defence reaction because they represent the young. One of the university's duties is to immunise society against attacks by dogmatic and demagogic thinking and against the short-term interests of politics and commerce. The university is a laboratory in which new generations are educated to lead the world towards a better future, in science, in business and in society. In the process, we must not be afraid of building ivory towers. The great thing about a tower is that it gives you a better vantage point and allows you to sooner see a better future or looming danger.

If the Zeitgeist teaches us one thing it is that the role of scientific research goes beyond developing new knowledge or technology. The core values of science are essential to a full-fledged, resilient society: a love of detail, respect for facts and uncertainties, critical queries and dialogue, healthy scepticism and amazement at the endless wealth of nature and the human mind.

Dear guests,

Twenty-five years ago I was appointed professor at this very university. It has been a privilege to be able to spend such a large part of my professional life surrounded by like-minded people as well as by people with differing views. I am grateful for the many friendships, collaborations and interactions that the university has offered me, but most of all for the freedom to be able to think, write and speak, and for making me feel at home in science.

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