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Where innovation starts

## Experience this book with the TU/e AR app!

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Augmented Reality (AR) brings reality and the virtual world together. Thanks to an app on your smartphone or tablet, AR gives you a virtual layer on top of what you see. It brings the pages to life with 3D animations, videos and extra photos. You can see this additional layer using the TU/e AR app. On a number of pages in the book you'll see this icon:



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### How it works

- Download the free TU/e AR app from the App Store or Google Play
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- Hold your smartphone or tablet over the page with the TU/e icon, and see how the page comes to life!

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When you've downloaded the app, just scan the cover and view the 3D animation to see 'Where innovation starts'.



# “We are driven by curiosity and excellence”

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**ir. Jan Mengelers**

President of the Executive Board

How do you tell the story of a community of almost 10,000 students and 3,000 staff? What’s the shared ‘DNA’ of all those people on the TU/e campus who are inspired by technology each day? What’s the common factor that connects our present and our future to the ideas of the university’s founding fathers? And what is it that makes our university so special?

During the 2013-2014 academic year, dozens of involved students and staff thought about these questions, and went in search of the shared values and passions that define us as Eindhoven University of Technology. What they were looking for was that authentic story; a message that goes a lot deeper than just promotional literature.

Please allow me to add a personal note. The process of tracking down the specific DNA of TU/e was already in full swing when I joined the university in March 2014 as President of the Executive Board. It is the same university at which I started studying in 1972 as the eldest son of a mining engineer, and where I gained my engineer’s diploma in Mechanical Engineering more than six years later. I feel an extra sense of connection with this university because I also recognize the shared theme that runs right through TU/e in my own life and career. That is undoubtedly linked to the Zeitgeist. I became fascinated by the wonderful world of technology, and by all the useful things you can do with it. That was true in the 1960s and 1970s, and it still applies today. At that time, technology contributed to increasing welfare. Today, technology also provides answers to major challenges in the fields of health, energy and mobility. The emphasis is now both on welfare and well-being. In its engineering education, our university has broadened its profile from the intrinsic scientific disciplines to other, related knowledge domains. I have also found to be an enrichment of the overall competences.

What are TU/e’s distinguishing features? In our research and our education, we are driven by curiosity and excellence, with a focus on the societal challenges. In many cases, we work closely with industry. Both our staff and students strongly share a feeling that is based on the friendly atmosphere, and on the accessibility and openness that you find on our lively, compact campus. With short lines of communication between people and between the buildings. All of this makes TU/e a university that derives its energy from the interplay between inspiring people, challenging science and highly-relevant applications.

You will find a lot of evidence to support these views in this book through a number of personal portraits of students and staff. I hope that you’ll find it both interesting and inspiring.



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# Where innovation starts

# Connections

*If you walk around TU/e Science Park, you can't fail to notice the covered walkways that connect all the university's departments, lecture halls and laboratories. Their design is based on a 1956 plan through which the architect Sam Van Embden aimed to show the places where staff and students could meet, and how those places should look. The idea didn't just come out of the blue. There was a research philosophy behind it, going right back to the founder and first director of the Philips 'NatLab' – the Philips Research Laboratory – Professor Gilles Holst. He wanted to create a scientific culture in which informal contact between disciplines was encouraged as much as possible, based on the idea that those contacts would lead to collaboration and innovation. Holst was also one of the founding fathers of TU/e. His research philosophy is still an important pillar of the university. Today, in 2014, all the walkways come together in the MetaForum building, the educational heart of TU/e. In this way, the network of walkways also symbolizes the essential connections between education and research.*

# University with a mission

Many of the passions, values and ambitions that the university holds dear today were already in the hearts and minds of its founders. The history of TU/e is important in more than one way for who we are today. In the 1950s, TU/e was exactly what the Netherlands needed: a second university of technology to give a strong impulse to the reconstruction after the war and the growth in welfare. A university with a societal mission. Technology carried with it a spirit of optimism and progress. Eindhoven formed the heart of a powerful, innovation-driven industry operating on a global basis. Philips needed increasing numbers of scientifically-trained engineers and due to the cooperation of industry, local government and academics TU/e was established in 1956. Sixty years later, the sense of a societal mission, the optimism and belief in progress, and the close cooperation between university, industry and government, are still essential parts of the DNA in Eindhoven. They contributed to the leading position that *Brainport Eindhoven Region* holds in the 21st century. Both nationally and internationally, Eindhoven is regarded as a hotspot for innovation and high-tech, making it one of the initiators of the knowledge economy. The lines of communication are short, and there is an open attitude. TU/e is proud of its position as the university with the largest number of research publications together with industry worldwide.

# Engineers for the future

At the heart of this region, TU/e aims to be an inspiring university of technology, educating new generations that can provide the answers to society's *grand challenges*. Those new generations of engineers, designers and researchers get the best education that TU/e can give them. Research and education are inseparable in that process. *"They're both part of the same 'fabric'"*, said Rector Magnificus Posthumus at the beginning of the 1960s. Lecturers search for the limits of knowledge, driven by scientific curiosity or societal questions. Science is like sport at the highest level: researchers want to get the best out of themselves, but also out of their students. TU/e deliberately opts for a small-scale educational model: the 'master – apprentice' relationship between lecturer and student is an essential element of academic education. That education is increasingly driven by students' ambitions, while lecturers are moving towards the role of coach. What is more challenging for master's students than pushing their limits in a research group of young people and experienced researchers who share the same fascination for science, technology and applications? Regardless of whether they are from the Netherlands or China. Because the TU/e population is becoming increasingly diverse. For both education and research, the whole world is the playing field on which only the very best will survive. That's why drive for excellence has absolute top priority for TU/e.

# Real world problems

TU/e aims to be an incubator for innovation, and that ambition is shared by our students. An excellent example of that is the group of talented students who realized their dream of designing and building the world's first solar-powered family car in 2013. They approached professors and industry in the region to find the answers to their questions. As one of the students in the team put it: *"I've learned to be open to suggestions from people who know more than I do. I've been studying for three years, and what I've learned most of all is the process of learning. The real job only starts when you have to make something – finding solutions for real-world problems with real-world deadlines."*

Technology at TU/e is linked to societal relevance. How can we find smart solutions for transport? What can we do to solve the future's energy problems? How can we use technology for better healthcare? Fundamental and application-oriented research go hand-in-hand. Practical questions lead to fundamental research, and the results of that fundamental research create new openings for unprecedented application opportunities. That's how TU/e has developed into the university of smart systems and materials. Those systems play a central role in virtually all intelligent products and services.

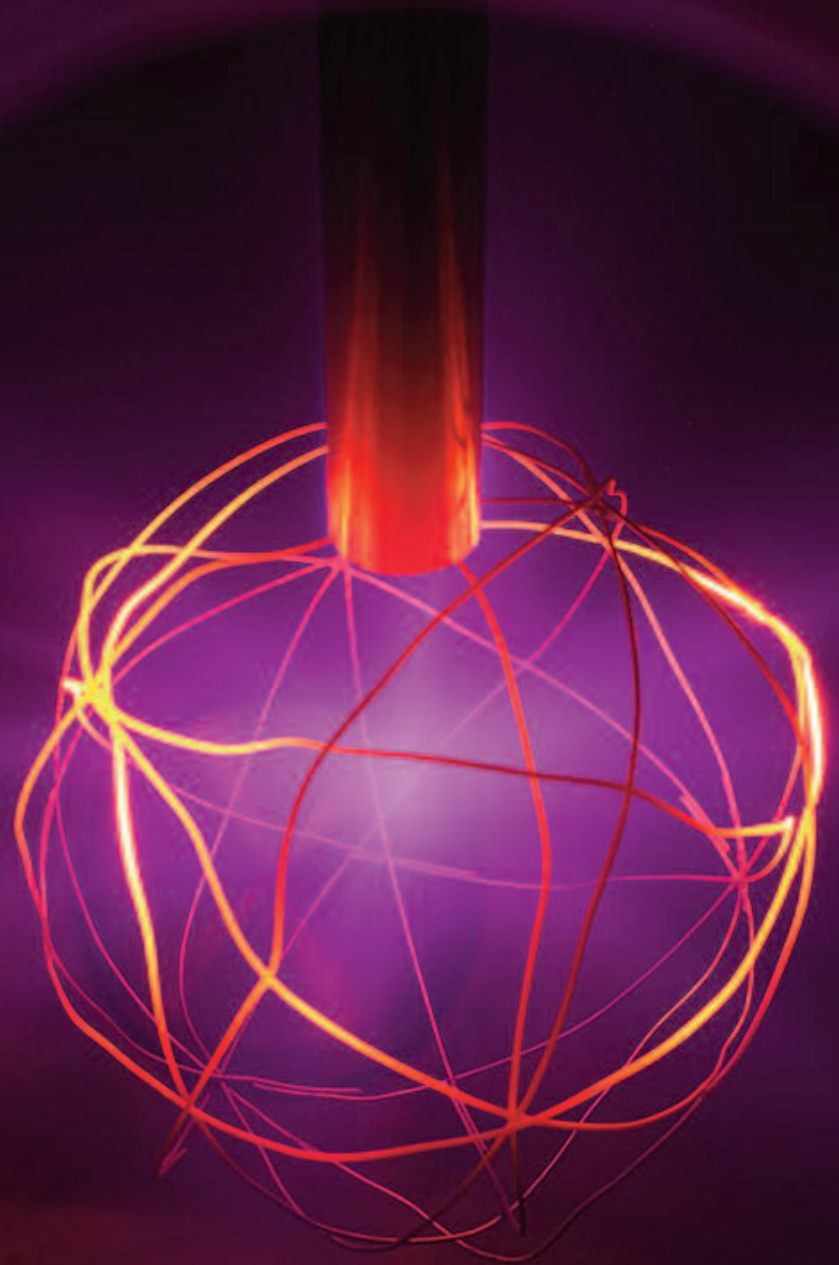
# It's all about people

Anyone who talks to students or staff about the atmosphere at TU/e will often hear descriptions like 'open', 'informal', 'friendly', 'collegial' and 'easily accessible'. Both students and staff soon feel they're part of a community. Trust and shared ambitions lead to a strong sense of connection. Collaboration between disciplines (natural sciences, engineering sciences, social sciences and humanities) is considered of paramount importance. That also applies to the collaboration with a select group of universities, industries and organizations in society. Innovations start with people, not with technology. People who are open, passionate, curious and connected. People with expertise, dreams and ideas. Those people are vital to TU/e. They are the people who make TU/e the place '*where innovation starts*'.



## Fusion power: unlimited clean energy

Students at work in the educational PlasmaLab at TU/e. They are enrolled in the MSc program 'Science and Technology of Nuclear Fusion', a unique Master's program in Europe. Through this program, TU/e is significantly contributing to educating the specialists needed for the international ITER project, the 500 MW fusion reactor presently under construction in southern France. Nuclear fusion has tremendous potential: unlimited clean, safe and CO<sup>2</sup>-free energy, but there are still some major obstacles to overcome. Fusion research is a distinctive feature of TU/e in the Netherlands, which attracts national and international students.





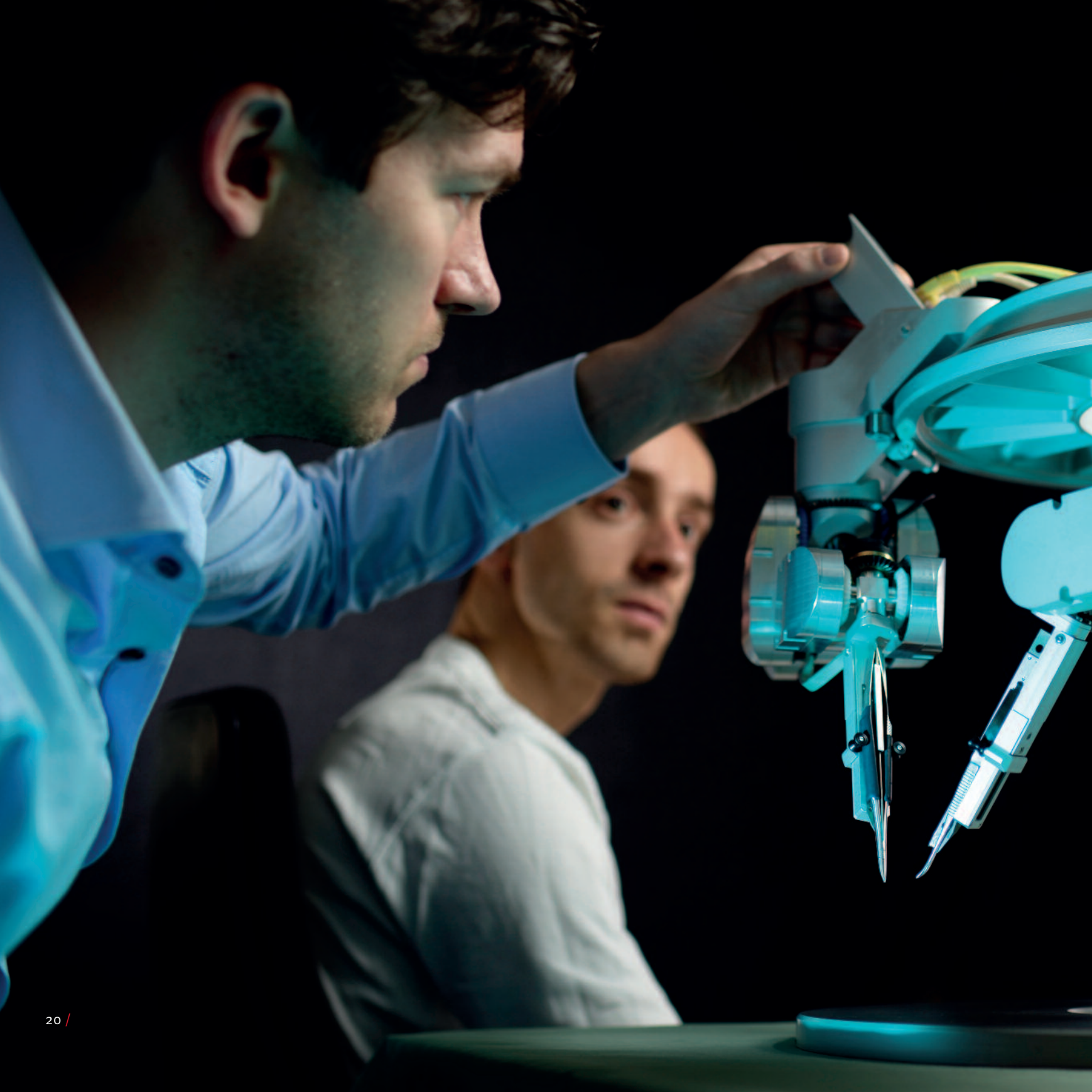


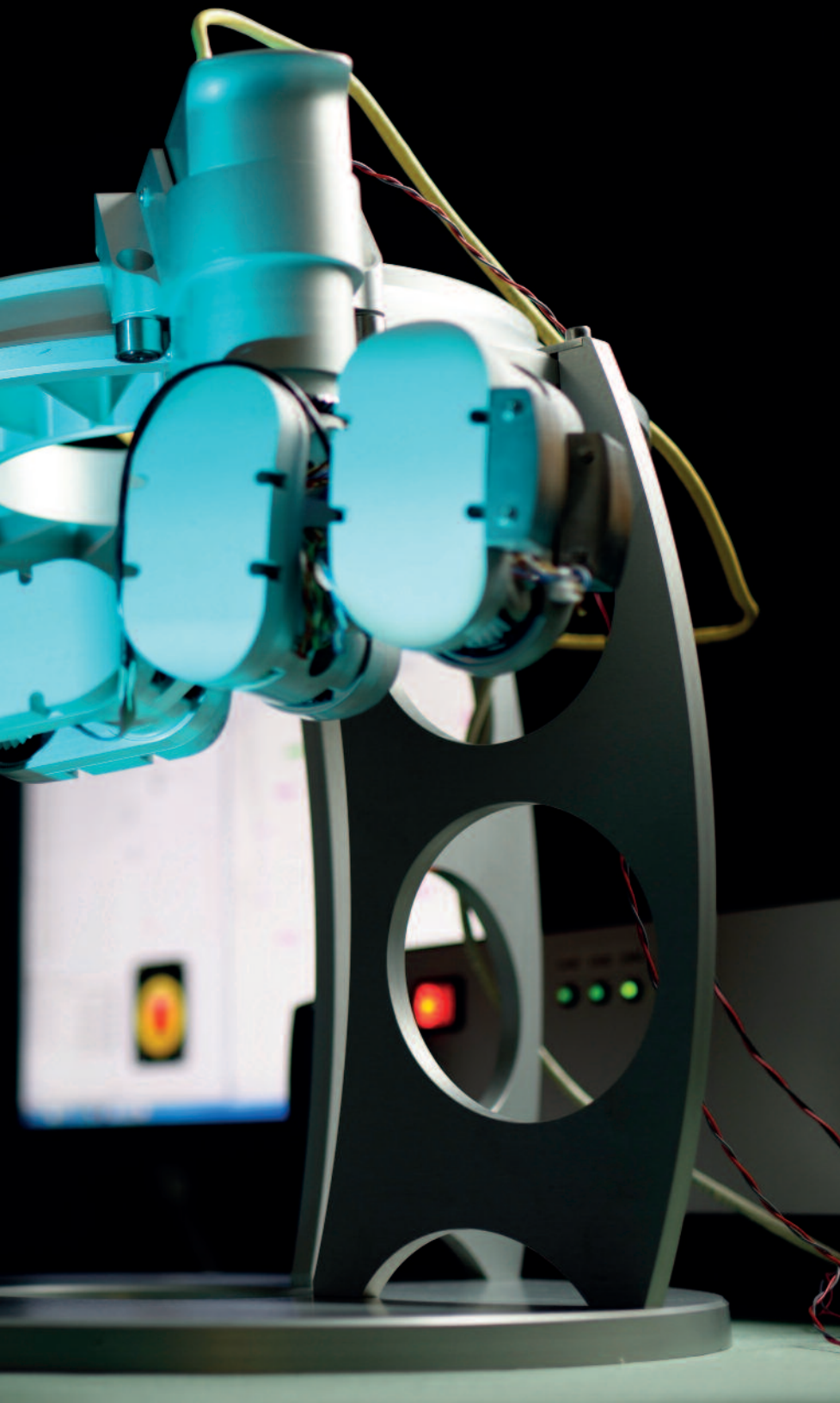
## World record for biggest ice dome

Master's students from the Built Environment department tested a new technique for building with ice using a mixture of ice and sawdust, called pykrete. In a challenging graduation project in Juuka, Finland, they built the world's biggest-ever ice dome. Its base measured 30 metres. And they set a new world record in the process! Building ice domes of this kind is not expensive and takes relatively little time. The structures can be used, for example, as temporary storage facilities.









## High-precision robotic surgery

Delicate operations require highly-experienced surgeons with steady hands. TU/e researchers have developed compact surgical robots, for use in for example eye operations and reconstructive surgery. They filter out all the unsteadiness and translate it into much more precise movements so even less experienced surgeons can perform the operations. These robots also enable completely new forms of treatment. A crucial factor in the development of these robots is mechatronics and control technology, a field of knowledge in which TU/e is among the world leaders.



## Data science reveals hidden insights

Organizations around the world generate ever-increasing amounts of data at tremendous speed – that's what 'big data' means. Advanced analysis techniques reveal unexpected relationships in all that data. This gives companies a competitive advantage that will be vital for their future survival. Hospitals, too, will be able to work a lot more efficiently. In 2013, TU/e set up the Data Science Center Eindhoven to meet the urgent need for knowledge and engineers.

This picture shows the mobile telephone traffic in Ivory Coast.



## Sustainable super-fibers

Liquid crystal polymers form an excellent basis for super-fibers. The resources used for the production of these super-fibers are currently oil-based, but are we also able to develop these fibers using renewable resources? TU/e scientists are working on 100% bio-based, super-strong materials, together with the Dutch Polymer Institute. They are performing research along the whole chain of knowledge, from the raw material to the end product. This integrated approach is characteristic for polymer research at TU/e, one of the areas in which the university holds a leading international position.





## Regenerative medicine: new heart valves that grow with the patient

TU/e researchers have made significant progress in growing living heart valves in the laboratory from autologous cells, i.e. using cells from the patient itself. With a living heart valve replacement, young heart patients no longer need to undergo frequent operations to replace outgrown artificial heart valves. Making cells grow into functional tissue is a big challenge. TU/e research into macromolecular chemistry and cell behavior provides new materials that support the growth of cells and control their development through bioactive signals. It's now possible to make implants that form new, living heart valves inside the body itself.



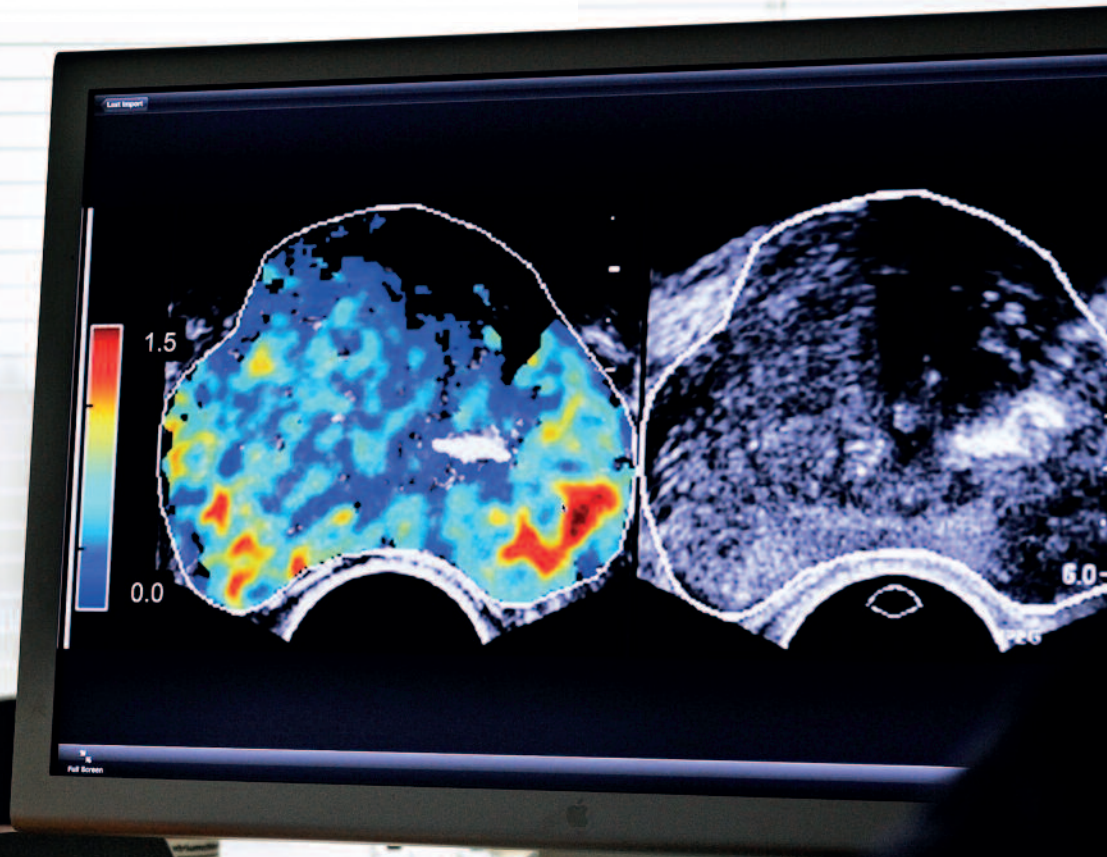


## Understanding life at the molecular level

Self-organization is the most striking characteristic of life: large, complex molecular structures that ‘build themselves’. The TU/e Institute for Complex Molecular Systems addresses the fundamental question of exactly how this works, and how we can use the underlying principles to make technological and medical breakthroughs. For example, scientists have succeeded in organizing hundreds of thousands of sophisticated molecular building blocks into dynamic triple strings, as shown in this computer image.

## Microbubbles reveal prostate cancer

Each year prostate tissue samples are taken from more than a million men using long biopsy needles to check whether they have cancer. This procedure is painful, and often unnecessary and inaccurate. Researchers at TU/e have developed a painless and more precise method. They inject 'microbubbles' that enable them to see inside the tiniest blood vessels. Using advanced image interpretation, the researchers can recognize tumors by their characteristic blood vessel patterns.





**Dr.ir. Yvonne de Kort**

Associate Professor Environmental Psychology

# “Science is here to help humanity”

**“I wasn’t sure if I was a real scientist or not. Eventually, I realized that I am because I am driven by questions.”** Though she originally had her doubts about her place at the university, Yvonne de Kort (1969) is a homegrown product of TU/e. A self-described ‘generalist’, her ability to form links across disciplines makes her an indispensable and valuable asset to the university’s research community. Born in the Eindhoven region and raised in various Dutch towns, she returned to Eindhoven to earn her engineering degree. Her inquisitive nature led her to TU/e’s PhD program where she completed her degree in Environmental Psychology, staying on as an assistant and later associate professor in the research group Human Technology Interaction. Her main focus these days is on light and its effect on people.

“I began my studies in the Mechanical Engineering department but then switched to what is now called Biomedical Engineering. But after two years in this department, I realized that I was working for people who I’d never see. I was just computing tension in their bones and what I really wanted was to have direct contact with people. That’s when I switched to the Department Industrial Engineering and Innovation Sciences.

## It takes all kinds

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After I completed my PhD in the research group Human Technology Interaction, an assistant professorship became available and I was interested. But I wasn’t sure if I was a real scientist or not. So I also started my own company as a consultant. I had my first baby around this time and I decided to work part-time. By having my own company, I wanted to test whether I was an entrepreneur or a scientist. This feeling was coming from inside me – I was always around these incredibly smart people and my environment was becoming increasingly competitive. I received little feedback and I had no female role models to look up to. Eventually, I realized that I am a scientist. I have lots of questions. There are simply different types of scientists. I’m not an expert in one specific, small area but I am an expert in combining fields and insights. I’ve come to see that this is an asset and that those sorts of scientists are needed as well.

## The impact of light

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At the moment, my heart is in light and its effects on people. I’m drawn to this question because it’s broad. There’s the biology of it, the influence on performance, the psychology of it. You need to be able to unite all of these insights. At the moment, I’m working with people from the Intelligent Lighting

Institute (ILI) which is an interdepartmental institute at the university. I'm the program manager of the Sound Lighting thematic research line which explores how applications of light could be beneficial to health and well-being.

One of our research projects focuses on a street in Eindhoven called Stratumseind – it's the place for students and adolescents to hang out. There are over 60 bars in the area but the problem is that there are also 800 violent incidents a year there. Even though it's the most popular area for going out, it also has a bad image. We're collaborating with the municipality, with Philips, the police, and other parties to install new lighting on the street to test whether we can improve the atmosphere. This is pioneering work that we're doing – what are the social effects when you change lighting schemes in order to, for instance, de-escalate an aggressive situation? The lights will be able to morph from a warm-ish white to a cool-ish white and they'll also change in intensity. They will also be RGB (Red, Green, Blue) so we'll be able to change to any color we want. We're thinking of preventative measures but we also hope to induce some minor frustrations in the street and learn how responses could be manipulated depending on the light scenario. I'm not interested in only testing things in a lab. I want to know whether they also have meaningful effects in the real world.

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*“I'm not interested in only testing things in a lab. I want to know whether they also have meaningful effects in the real world”*

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## Psychologists needed

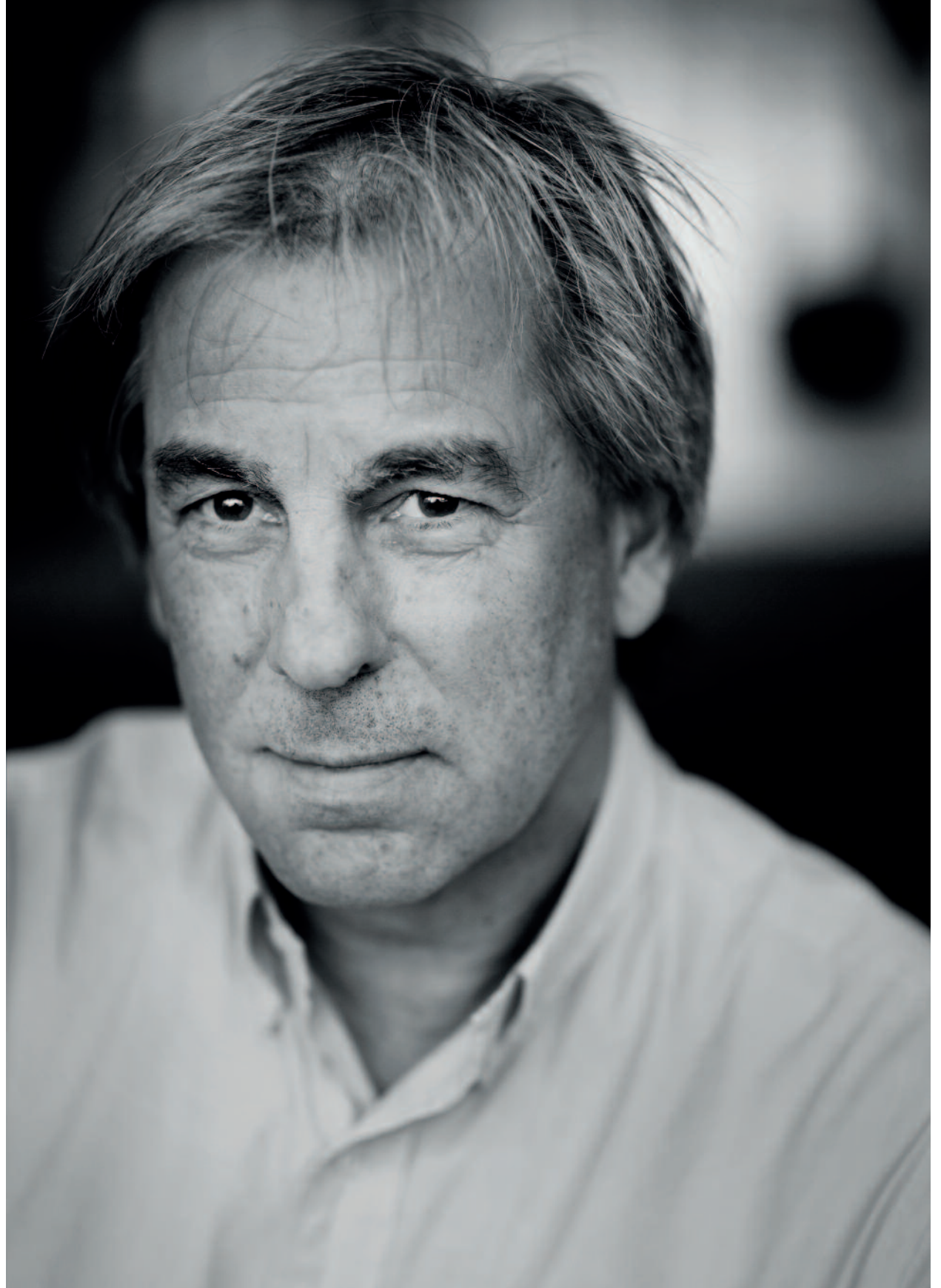
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Because TU/e is a technical university, people might think that everything here only revolves around technology. But we have to also remember that, in the end, science is here to help society. And in order to do that, you need to understand what people need and how technology affects them. From the moment we started to use tools, those very tools started to change us – our perspective on the world and the skills we developed. And this effect will only become more pronounced now that technology is ubiquitous. Every technological university needs a department with psychologists, so that we can better understand this relationship.”

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*“Every technological university needs a department with psychologists”*

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## **Prof.dr. Bert Meijer**

Professor of Macromolecular and Organic  
Chemistry and Distinguished University Professor

# **“We’re good at improvising and adapting”**

**“Madly in love with inaccessible beauty.” That’s how Bert Meijer (1955) once described his fascination with molecules. After finishing high school, he studied Chemistry in Groningen, where his supervisor helped him to discover his love of science. After earning his PhD, he was faced with the choice of studying as a postdoc in the USA or taking a job at Philips Research in Eindhoven. “I made my choice by tossing a coin, and it was Eindhoven that came up.”**

After seven years of fairly fundamental work at Philips, he moved to DSM Research where he saw even more clearly that science is essential for new developments. This was followed in 1990 by his appointment as professor of Macromolecular and Organic Chemistry at TU/e. Bert Meijer is the founding father of the Institute for Complex Molecular Systems (ICMS), Distinguished University Professor, and chairman of Studium Generale, the TU/e arts and culture society.

## **Pushing limits**

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“I came back to TU/e to educate students to do a wide range of jobs – to build a group that can continue my legacy. It’s great to encourage students to push their limits, and to help them on the way to careers in science, industry or other roles in society. That’s what I see as my main task – giving students the opportunity to develop in their own ways that fit into the DNA of the group. I’m looking for originality and attention to detail. You have to be able to think out of the box, and to make a significant contribution to your field of work. I believe that people need the space to experiment. And that we have to constantly strive to come up with new ideas, to develop new understanding, and to do things that have never been done before.

That’s a role we’re well known for in Eindhoven. We strive for fundamental knowledge, and we connect that to what the world needs. That may not immediately lead to concrete products that will solve real-world problems, but I’m sure we’re paving the way for breakthroughs in twenty or thirty years from now. What’s also characteristic for TU/e is improvising and adapting. There’s a strong ability here to respond to changing situations. Also, you have a lot of personal freedom here as a scientist to get things done.

## Performing at the highest level

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My personal drive is in educating students who can advance scientific knowledge. My highest goal is to contribute to developments that are unique, and that can make the difference. Will we ever be able to create artificial life? I think about that a lot. At the end of the day, our knowledge and understanding will contribute to sustainable production of materials, or to breakthroughs in medical science. I've built up a reputation as a kind of example in the 22 years that I've been at TU/e. I was appointed as the first Distinguished University Professor, I've been Bachelor Lecturer of the Year at TU/e and I received the Spinoza prize in 2001, the highest Dutch award in science. Of course, that kind of recognition is good for your ego, but at the same time it puts a lot of pressure on you to keep performing. I also have the role of TU/e ambassador for all kinds of occasions.

What we're doing here together is like sport at the highest level. I'm a coach and a figurehead at the same time. It isn't really part of our culture to win personal medals or to reach individual peaks of performance. I'd rather do that together and go for shared achievements. What we don't always notice is that our knowledge can sometimes be the missing piece of the puzzle for someone in a different discipline. For example, a molecule that we developed turned out to be used in Japan in a polymer pharmaceutical that controls phosphate levels in the body.

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*“We strive for fundamental knowledge, and we connect that to what the world needs”*

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## Our diversity is our strength

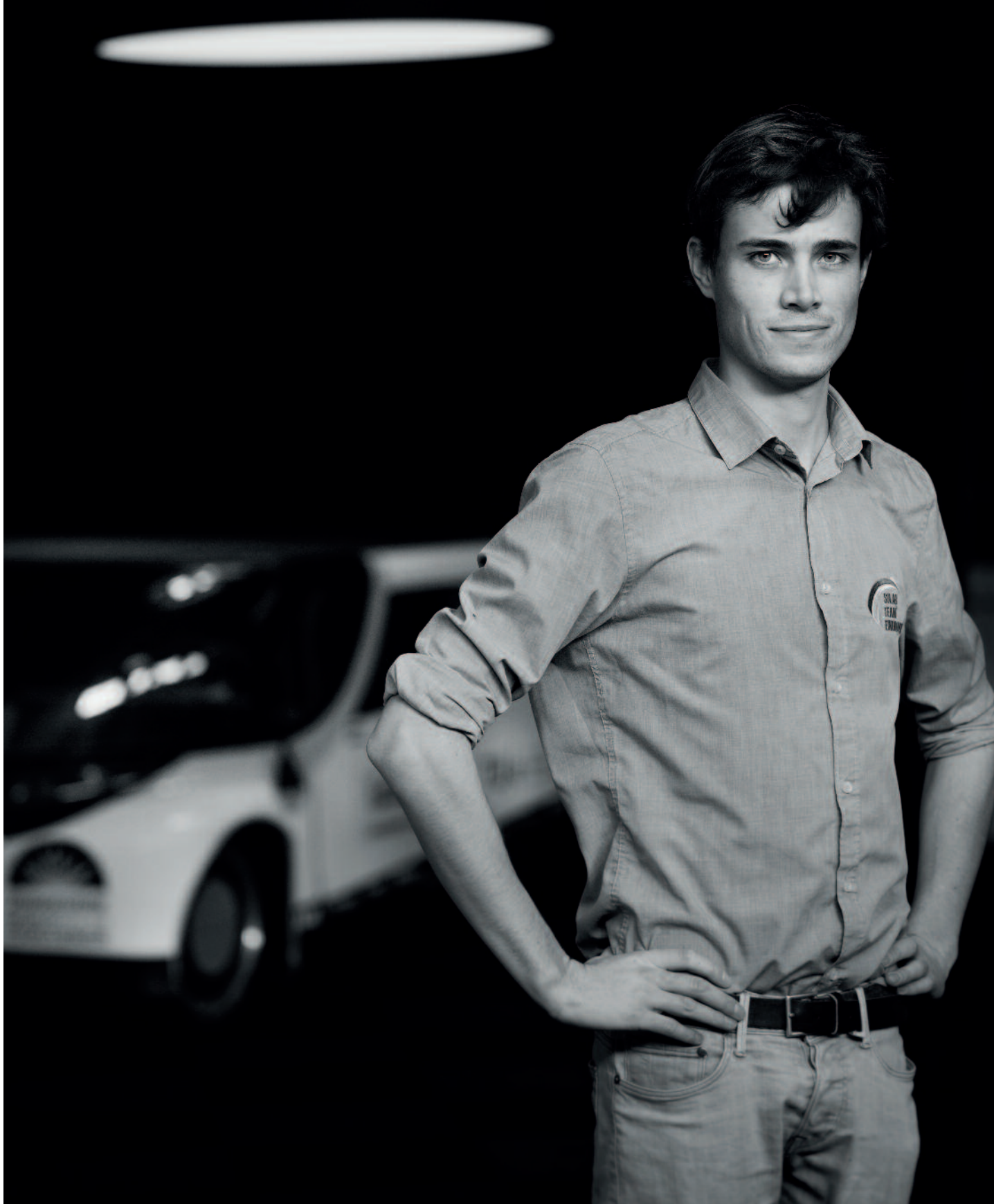
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We're still at the very early stages of our knowledge about the relationships in the molecular world. We want to identify them and understand them, and that takes effort and motivation. Is there something we've missed? Some details that we haven't identified? My focus is on continuous improvement of results. That's what I expect of myself and my team in the Institute for Complex Molecular Systems. That sometimes leads to a dilemma: you want to publish at the right time, and then you sometimes have to be pragmatic and simply accept that you can't research a subject in even greater depth. We have to strike a balance between striving for excellence and helping students to make progress. But, fortunately, my international contacts mean I can open a lot of doors, and can arrange research posts for students at leading universities around the world. At TU/e, I can see opportunities for collaboration between departments, for example, with disciplines such as mathematics, physics, biology and mechanical engineering. That's enriching. Our diversity is our strength. I believe we should build recognizable clusters of departments that may well differ from each other, but that still share strong connections.”

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*“My focus is on  
continuous  
improvement of  
results”*

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**Lex Hoefsloot**

Mechanical Engineering Student

# “It’s all about pride, excitement and your sense of identity”

**When he was five, Lex Hoefsloot (1990) moved to the Netherlands from Africa, where his parents worked for the UN. As a boy he wanted to be an inventor, and he took vacuum cleaners apart to find out how they worked. When he was eighteen, he decided to study at TU/e. Together with a close team of students, he was one of the initiators of the first solar-powered family car, which put in a great performance in Australia in 2013.**

“In high school, I did lots of experimenting with computers – for a while I was a fanatical ‘overclocker’. It’s a bit like tuning a moped to make it go faster. You do that by adjusting the internal clock of the processor, purely to make it work at record speed. You take the computer apart, fix a kind of pipe around the processor and fill it with liquid nitrogen. That makes the processor ice-cold, and enables you to increase its operating speed.

## Real science student

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After high school, I decided to study Mechanical Engineering at TU/e, which matched my interests. I’m a real science student. I always enjoyed starting new things. Because I wanted an extra challenge, I decided to apply for the Honors program in my second year. That’s forty students who all eat together, go on vacation together, follow evening classes and, above all, inspire each other. In the department, I took the courses that I needed later for my chosen discipline, while in the Honors program the focus was on broadly-based studies. We heard some interesting personal stories from top people at TU/e. That’s when my interest in automotive started, when I discovered how big the sector is here in the region.

## Big ambitions and a lot of stress

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After the Honors program we came up with the idea of Solar Team Eindhoven. We believed it was possible to build a solar-powered car, and to take part in the World Solar Challenge in Australia. We formed a core team, together with other students from the Honors program. It was a closely-knit group, working together on the basis of trust and quality. I’ve learned that you need to be very ambitious right from the start. We talked until late at night about how we were going to tackle the

project. We used our network and the short lines of communication at TU/e to approach lecturers and companies for advice. That gave us a lot of valuable feedback. We kept everything secret for months, until we were ready to present a well worked-out plan to the outside world. In July 2013, we were ready to officially unveil our car. Afterwards, we heard that people were initially very skeptical about our project. But the most important thing was that we believed in it ourselves. We wanted to show that we could build the world's first solar-powered family car. If you have twenty good students who are all prepared to work sixty hours a week on a project like that, you can achieve amazing results!

## Roller coaster in Australia

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Right from the presentation of Stella – that's what we called the car – our lives turned into a rollercoaster. There was a lot of media attention, both in Eindhoven and in Australia. Day four of the race was the worst day of all. Bad weather and an unbelievable side wind suddenly made the car's 'fuel consumption' increase by one kilowatt. And something burned out in the trunk. At that point, the whole team rallied and came up with a plan for how to replace the faulty part. Everyone had their own job to do, without anyone being in charge. That worked perfectly: within five minutes we were on the road again and later we were the winners of the race.

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*“My dream has always been to make a contribution to solving the energy problem”*

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## Contribute to solving the energy problem

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Working in a team is a great way to let students solve problems for themselves. You can link education and research, and you also make contacts with industry. But it all has to originate from the bottom up. You need the element of competition to meet the tight deadline and to keep motivation high, otherwise you won't be able to get everyone to make maximum effort the whole time. It's all about pride, excitement and your sense of identity. You won't succeed without the right academic basis, but I think I learned a lot more in that one year with the Solar Team than at any other time. Now we're handing over to a new TU/e team, who have the task of building their own new car. But they have to keep their hands off Stella! That means the prototype of the first solar-powered family car stays intact. My dream has always been to make a contribution to solving the energy problem. With my experience now, I truly believe we will all be driving cars like this one in the future!”

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*“The most important  
thing was that we  
believed in it ourselves”*

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## First solar-powered family car

It started as a wild idea and ended with driving on the public roads with the world's first solar-powered family car. Students from just about every TU/e department saw a dream come true in Solar Team Eindhoven. Their successful solar-powered car Stella, built in just one year, was licensed for use on the public roads. It also took first place in the Cruiser class of the World Solar Challenge in Australia. The emphasis in the Cruiser class is not on speed but rather on building a user-friendly solar-powered car.







A line of cars driving on a road at sunset. The cars are in a platoon, moving from left to right. The sky is a mix of orange, yellow, and blue. The road has white dashed lines. The cars are of various colors, including white and dark blue. The headlights are on, and the overall scene is illuminated by the low sun.

## Networked control systems

Cars are increasingly loaded with microprocessors and digital components, and that means ever-increasing data communication. All those components transmit signals over shared communication networks. Moreover, the future promises cooperative driving; traveling together in 'platoons', with wireless communication between the cars and their environment. TU/e is working on methods and technologies to control both types of complex networked systems, to make them effective and affordable and to ensure their safety.



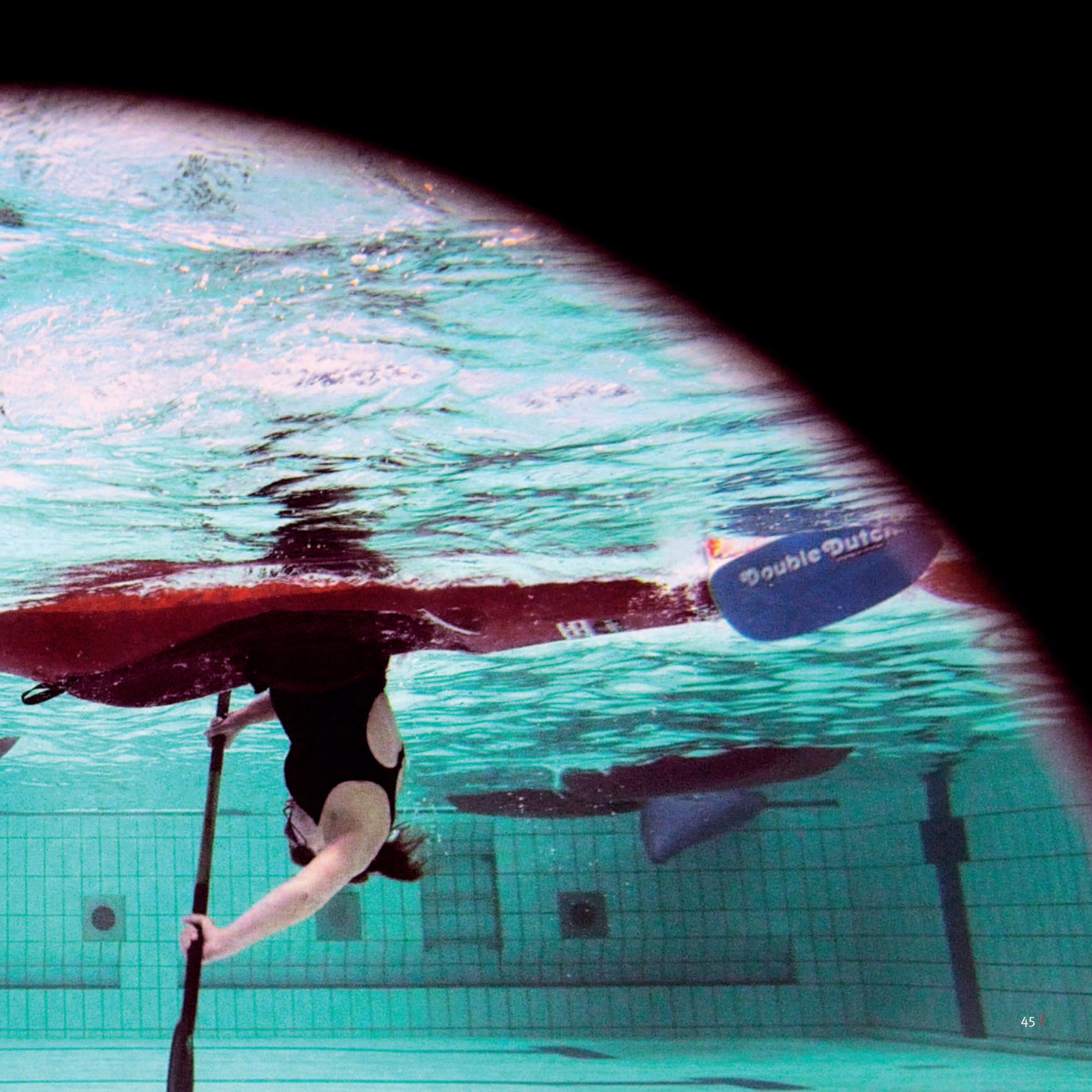
## Helping drivers to let go of the wheel

Self-driving cars are potentially safer and less energy consuming than their human-controlled counterparts, but only if drivers trust the technology enough to really let go of the wheel. TU/e researchers in psychology are investigating the interaction between people and new technology, and one of their aims is to improve its acceptance and implementation. Specifically, they are trying to increase trust by presenting human drivers with a virtual driver that looks, behaves and thinks like them.

## Wide choice of sports facilities

Studying and working hard followed by sports and recreation: it's a well-proven combination. The Student Sports Center at TU/e gives students and staff a wide choice of sports facilities: a competition swimming pool, tennis courts, an athletics track and a number of sports fields. The sports center is also home to the many student sports clubs in Eindhoven – from indoor soccer to ice hockey, and from water polo to fencing.











## Technology experience during the Dutch Technology Week

The Brainport Eindhoven region is famous for its innovative technology. Demand for engineers in the region is high. The Dutch Technology Week (DTW) is held each year to promote technology studies to young people and to increase technology awareness among the public. For a whole week, companies and institutes present technology innovations at various kinds of events. It's also when TU/e organizes the TU/experience Day. Young and old can experience technology during numerous activities dedicated to energy, health and smart mobility.





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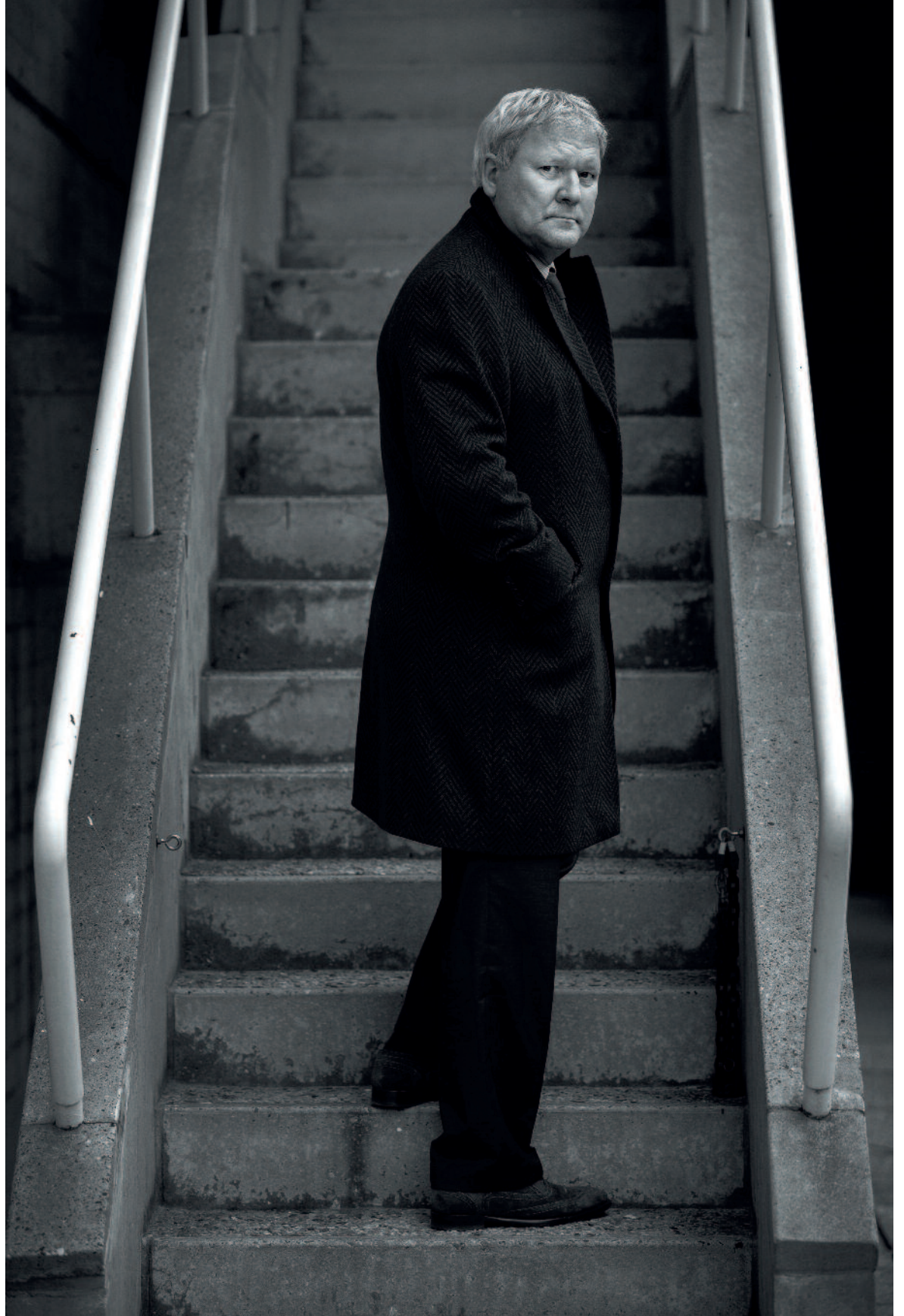






## Engineers of the future

It goes without saying that science is of great importance. But it's fascinating and fun, too! TU/e Junior organizes a series of events for potential young scientists to experience how much fun science can be. The aim is to get them interested in technology from an early age. In all kinds of surprising ways, they can find out about scientific phenomena and the principles of technology.



**Prof.dr.ir. Hans van Duijn**  
Rector Magnificus and Professor of Applied  
Analysis

# “Creating connections is in our system”

**Hans van Duijn (1950) calls himself an intrinsic scientist with an interest in complex systems and processes. “Over the years I’ve developed a nose for practical problems that are mathematically interesting.” Educated as an applied physicist at TU/e, he obtained his PhD in mathematics at Leiden in 1979. In 2000, he returned to Eindhoven as a professor, followed five years later by his appointment as Rector Magnificus. As a member of the Executive Board, he was the initiator of the Bachelor College at TU/e.**

“In high school I was already interested in physics, but I didn’t yet know how I would be able to use it in practice. While I was studying physics at TU/e, I gradually discovered the role that mathematics plays within the natural sciences, so I decided to switch my course. I was mainly interested in doing research into partial differential equations in fluid dynamics and model analyses. For example, one of the things I worked on was the way in which particles move through porous media. At the beginning of the 1980s, I worked for a few years in the Laboratory for Soil Mechanics (now part of Deltares), where I analyzed models that could be used to describe and predict ground contamination.

## Embedded in the region

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What I like so much about TU/e is its close link with industry. We’re strongly embedded in the industrial environment, and we work together with Brainport, High Tech Campus Eindhoven and Chemelot, the chemical industry campus in Limburg. We educate engineers who find jobs here in the region with renowned high-tech companies. On the other hand, these companies offer opportunities for research to advance scientific knowledge. In most cases these partnerships between TU/e and the region focus on specific technology areas. The collaboration between disciplines such as electrical and mechanical engineering, computer science and physics will soon enable us to address complex issues, and to come up with solutions that are directly usable by industry. The collaboration provides an economic boost for the region, as well as career opportunities for students. In addition, our innovations also create added value for society.

## Ready for the future

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As a university, we have a strong focus on giving students the best possible support in gaining a first-rate degree. It's not just a question of research results, but most of all it's about educating people who are able to realize innovations. We offer the broadest possible orientation, and we ensure that engineers trained at TU/e are right at the top of their fields. Our engineers are also entrepreneurial and communicative, with an international focus, and they are aware of the societal context. We encourage and support strong links between education and research, as well as knowledge transfer between the individual disciplines. This is demonstrated in all kinds of ways. Students are involved as junior staff members in research groups, and take part in international competitions.

## Involvement in the debate

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As Rector Magnificus, I see it as my task to build connections in different dimensions – for example, by giving good people the freedom to do breakthrough research. That enables us to recruit new talent, and strengthens our reputation. For example in the field of biomedical engineering, we've been able to make a number of promising breakthroughs. We are leading in a number of areas, although I think we don't always exhibit our achievements in the way they deserve. Engineers generally have a rather down-to-earth mentality, and they're less extroverted. In the future I'd also like to see more involvement in the societal debate on themes we are knowledgeable about, such as smart mobility, healthcare and energy. It would be great if we can find a better balance between our subject knowledge and that external focus.”

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*“Our engineers are entrepreneurial and communicative, with an international focus, and they are aware of the societal context”*

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**Dr. Yuan Lu**

Associate Professor Business Process Design

**“I see my own culture more clearly now ”**

**Dutch by choice, but Chinese by birth, Yuan Lu (1972) came to the Netherlands in 2000 to begin her career with TU/e. Impressed by her performance during a collaborative project with Philips in Singapore, her future PhD advisor persuaded her to make TU/e her academic home. She accepted and earned the first-ever joint PhD between the National University of Singapore and the Department of Industrial Engineering and Innovation Sciences. When she later joined the Department of Industrial Design, she became interested in how design can contribute to independent living for the increasingly aging population. Today, her work focuses on making technology meaningful for the elderly and influencing the design process in its initial stages – “It’s my job to teach the designer to make the right decisions.”**

“My initial interest in aging was something really personal for me. My grandmother passed away in China and I wasn’t around. After she was gone, my grandfather stopped eating and nobody understood why. I guess it was loneliness. Even though he had family around him, it just wasn’t enough. I think he gave up on life. My mother did everything to keep him alive, gave him good nutrition and water, but in the end it wasn’t enough. His death really triggered me.

### **Making numbers meaningful**

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I was really inspired by the spirit of TU/e. Through my interaction with the university, I learned that it’s not all about the numbers – there are more things that contribute to the life of a product. And this knowledge made me realize that I didn’t want to be a purely numbers person for the rest of my career. That’s why I chose for TU/e. I wanted to make the numbers meaningful and I saw the chance to make a real go of it here – to combine my personal interest in technology and the aging process with the interests of the university. Of course, elderly people here are very different than in China. They’ll adopt certain things if it’s valuable for them. In China, we have a materialistic culture. If your neighbors have something, then you should have it, too. Here it’s different and I was fascinated by the differences.

### **New in the Netherlands**

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I had a very smooth entrance into the Netherlands and TU/e; everyone was very nice and welcoming. The university was an enormous help with the culture and how to survive here. Of course, when my ‘honeymoon’ period was over, everyone started to treat me like a Dutch person and that’s when my culture shock began. You know, in Holland, we have very little hierarchy, especially in comparison

to China. For example, in China, if your boss gives you an assignment, it's done in a formal manner. You sit down in a room and he or she says, 'This is what I expect you to do.' One time, my Dutch advisor stopped me in the corridor and casually asked me to do something. I thought 'Oh, well, he asked me so nicely, I don't really have to do it.' Imagine my surprise when I found out that it had actually been a real assignment! It was a shock for him, too.

## Wisdom of the crowd

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I'm the leader for various projects that introduce technology to the elderly that will, hopefully, enhance their daily lives. One of these is the 'Wisdom of the crowd' project and the key idea is that everyone should contribute; everyone has something to bring to the table. My design students have created a new community culture for elderly people by linking multiple parties with collaborated wisdom. One of our projects gradually introduces new technology to the elderly in a non-technical, playful way. Once they experience how new technologies can help them, they often become enthusiastic. Technology acceptance is a relevant issue. Not everyone wants to be introduced to it but it's important that we support the ones who do. Some elderly people are very uncertain about technology. Some say, 'I would like to learn but I don't know where to start.' I was so proud to see how the students were working with the elderly. It's really an eye-opening experience for them.

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*“Designers have an important job and I hope my work will create a better quality of life”*

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## Persistence

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What are my strengths? I'm an open, social person and that really helps. Also, I don't give up. I'm a foreigner and when you arrive from another place, you have to work hard to build up a reputation. People trust me now and they come looking for me – both students and companies. After living in Holland for 14 years, I think I'm even more Chinese now than before. Living abroad really makes you get to know yourself. I see my own culture more clearly and my value in this context. I see my job as linking the university's technology with people on the outside, both private citizens and companies. Designers have an important job and I hope my work will create a better quality of life, not only for end users but also for the companies that need our support. I hope that we can make technology commercially valuable and also meaningful for society.”

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*“I see my job as linking  
the university's  
technology with people  
on the outside”*

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**Prof.dr.ir. René Janssen**

Professor of Chemistry and Physics and  
Distinguished University Professor

# “Our contribution to society is most of all in education”

**In his view, the boundary between physics and chemistry is becoming less well-defined. He is at home in both disciplines, so it's no wonder that he is a professor in two departments: Applied Physics and Chemical Engineering and Chemistry. In 2013, René Janssen (1959) was also appointed as Distinguished University Professor.**

**“I think it's important to understand a phenomenon so you can manipulate it. And if we can do something smart to improve our plastic solar cells, then I'm sure to have a great day.”**

“The passion for my work started when I was in high school. I liked doing complex sums and solving puzzles. The more difficult, the better. And when they were finished, the fun was over. There has to be a challenge, a competitive element. I'm fascinated by the boundary area between chemistry and physics. I want to know how nature works, to do something that no-one else has done before.

## The magic of molecules

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My challenge is being able to make electro-optical circuits using organic molecules. In a way that's a bit like what happens in the human body. Printed circuits are normally based on silicon. Part of the satisfaction is the fact that people from all over the world want to join up with you and recognize that you're working on some interesting developments. We want to find the answers to fundamental questions and create applications that make the difference. For example, telephone displays have already been developed based on organic molecules. We're currently working on new concepts to make solar cells more efficient, flexible and to reduce the cost. We may even be able to come up with new applications that haven't yet been developed. For example, could we use some of the light falling on the displays of tablets for charging, while we're using them at the same time? There's always something that can be done better or differently. The things we're working on now will, in principle, only be ready for use in ten or fifteen years from now.

## The future starts today

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In my Molecular Materials and Nanosystems group the links between chemistry and physics are a prerequisite for good results. It starts with the chemist who makes a molecule, and it ends up with a transistor or solar cell that has to be described

and designed by a physicist. We chose that synergy right from the start. University researchers from all over the world are constantly influencing each other to increase the depth and breadth of their work. The contribution we make to society often isn't really clear until later. Will solar cells be the technology for generating energy? Will we all have a drone in our garden in the future, that we can use to send parcels? It's all about bridging the gap between today's reality and the situation we want to achieve in the future. That's the dynamic in which science operates.

## Foundation for success

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I can see different cultures at TU/e as an organization. People in Built Environment or Industrial Engineering have different views from those in Chemical Engineering or Applied Physics. At the same time, you can see some aspects that are characteristic for TU/e. We're a small-scale university - it's quite easy to get in touch with colleagues. This approachability and the short lines of communication make it easy to start up new projects. It's good to work here because you can realize your own ambitions. At the same time, you're aware that you're part of a real community, in which you have the opportunity to learn and to push your limits. TU/e creates the foundation for success. Our message is that we're open to every good idea, and we're ready to create opportunities.

## Revitalization and renewal

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What characterizes us is that we want to reach as high as possible, provide the best possible education and do the best possible research. Our contribution to society is most of all in education. I think the subsidies that we receive for our research prove that we're looking for answers that society really wants. I can see TU/e is changing. I think it's a good thing that engineers are getting a broader outlook. But we also have to continue giving excellent students the opportunity to do in-depth work, enabling them to make research breakthroughs. Fortunately, education and research are strongly complementary, and the inflow of young people ensures that as an organization we're in a constant process of revitalization and renewal."

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*“It’s all about bridging  
the gap between today’s  
reality and the situation  
we want to achieve in the  
future”*

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## **‘Master-apprentice’ interaction: a key component of academic education**

A compact campus, a friendly and open atmosphere and short lines of communication with lecturers and professors. Even though digital teaching of large groups is rapidly gaining ground in the university world, personal contact between students and lecturers has the highest priority. Lecturers play a vital role in this ‘professional coaching’, based on strong personal interaction and knowledge exchange with students. This is a key component of academic education at TU/e.









## Logistical mega-challenges

How do you get 200,000 cases and bags in the right holds of more than 1,000 different flights, on time, day in and day out? Handling the baggage flows of airports like Amsterdam Schiphol is tremendously complex. And making sure they run smoothly requires advanced automated sorting and transport systems, based on solid modeling and mathematics. TU/e is contributing to the development of these systems with its expertise and research in queueing theory, control, embedded systems and system reliability, working closely with partners like Vanderlande Industries.

## A good start

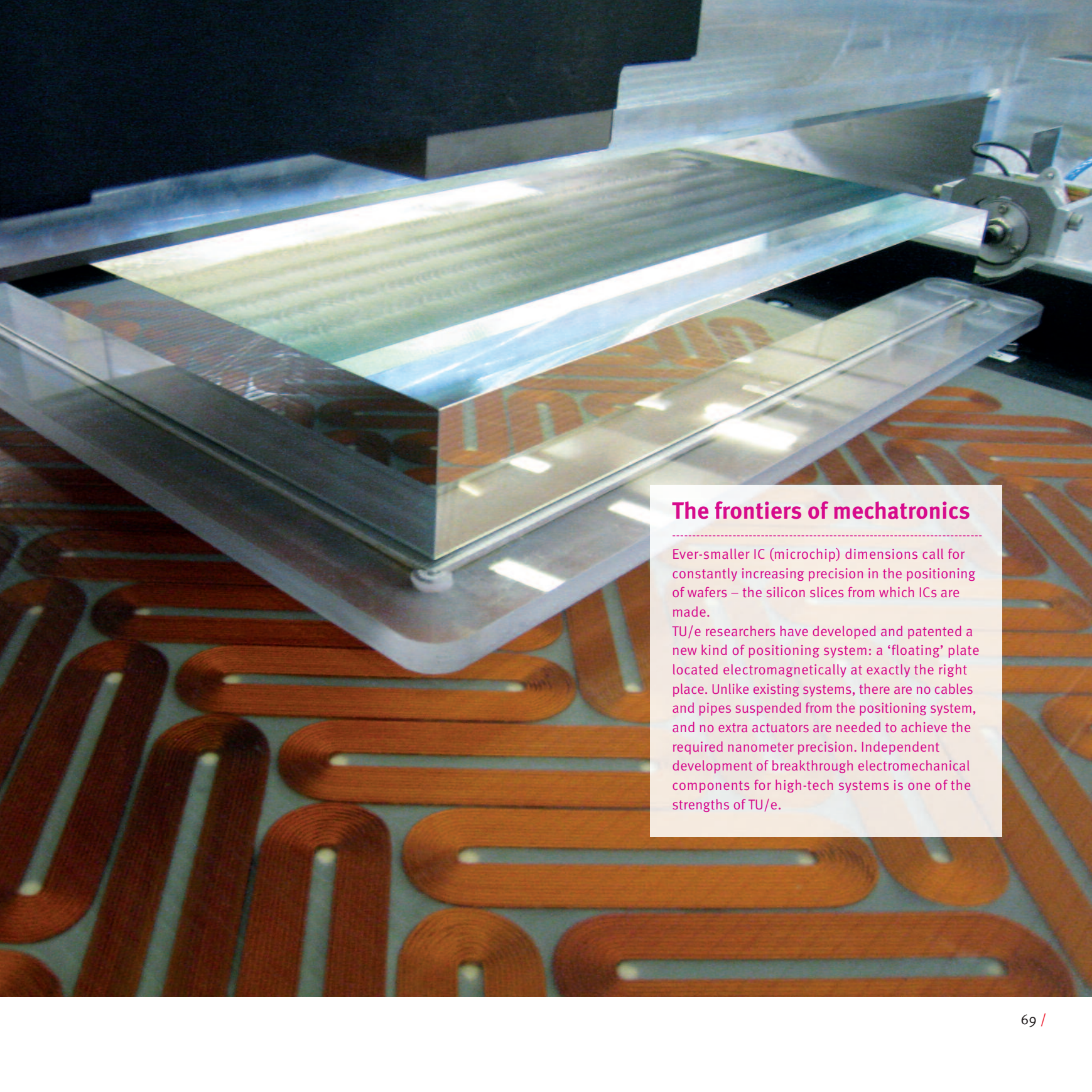
The annual Business Day on the TU/e campus allows more than 100 companies to present themselves to students. For them the Business Day is a chance to take a look at different companies within a short time, and to find out about career opportunities after their studies. The Business Day is part of the Recruitment Days, the TU/e career event which aims to help students find the internships or jobs that match them best. These events help the university to prepare students for the start of their careers.





## A student-centered Bachelor College

TU/e has started a far-reaching educational reform with an eye to the future. In the Bachelor phase, students have a lot more freedom to design their study programs based on their own interests and ambitions. They choose whether they want to follow a broadly-based education with socially-oriented courses or a specialized, scientific education. The Bachelor College at TU/e educates engineers with the different profiles that industry demands: from strongly-focused to broadly-based with a wider spread of depth.



## The frontiers of mechatronics

Ever-smaller IC (microchip) dimensions call for constantly increasing precision in the positioning of wafers – the silicon slices from which ICs are made.

TU/e researchers have developed and patented a new kind of positioning system: a ‘floating’ plate located electromagnetically at exactly the right place. Unlike existing systems, there are no cables and pipes suspended from the positioning system, and no extra actuators are needed to achieve the required nanometer precision. Independent development of breakthrough electromechanical components for high-tech systems is one of the strengths of TU/e.



## Chemical processing reinvented

The heart of a chemical plant is usually the continuously-stirred vessel. There, the chemicals, diluted for safety, slowly react into the desired product. A revolutionary reactor was developed at TU/e; the spinning disc reactor. Through this process high concentrations of chemicals are mixed safely and very fast. The reactor is much smaller, safer, cost-efficient, uses less energy, generates less waste and operates solvent-free, which is beneficial for the environment. TU/e spin-off Flowid, will introduce the technology to the market, and has high ambitions for its success.



## Graduate School educates future engineers

Industry needs future engineers: engineers and PhDs with an international focus who make an innovative contribution to society's needs.

Engineers with a vision that extends across disciplinary boundaries. The TU/e Graduate School gives students a choice of graduate programs, each focusing on a specific research domain. It also provides students international experience and a better transfer to PDEng programs, a PhD path or a job. Thanks to TU/e's strong link with industry, the graduate programs are an attractive proposition for students from all over the world.





## Catalysis: key to solar fuels

Making liquid fuel directly from sunlight and CO<sup>2</sup> or from biomass. Researchers at TU/e are working on this sustainable energy solution together with Utrecht University. The biggest challenges are in the field of catalysis, a long-established strength of TU/e. Researchers at the university are using and building further on their fundamental knowledge to design catalysts that enable conversion processes.



## Designer programs accelerate careers

The close ties between TU/e and technology companies are attractive for PDEng trainees. More than eighty percent of the trainees at TU/e come from abroad, and their community is a very close one. A designer program accelerates careers, and on average more than fifty percent of the international graduates accept jobs in the Brainport Eindhoven region. As with PhDs, PDEng trainees are employed by the university. In the first year they work on various multidisciplinary industrial design projects. In the second year the trainees undertake individual, large-scale design projects in companies.





**Prof.dr.ir. Lex Lemmens**

Dean of the Bachelor College and Professor of Academic Science

# “It’s about content and passion”

**Lex Lemmens (1955) studied Chemical Engineering at TU/e and earned his PhD with research into technology assessment in the third world. In 2011 he was Program Director for Industrial Engineering & Innovation Sciences, when he was asked to lead the implementation of the biggest educational reform in the history of TU/e: the Bachelor College. In 2013 he was appointed as professor of Academic Science and Engineering Education.**

“As a student I felt right at home in the Chemical Engineering program, and on the TU/e campus in general. In the mornings, we had lectures and in the afternoons, practicals in the lab: directly putting into practice what we’d learned. It was fantastic. Finally, I took the opportunity to specialize in quantum chemistry, and I increasingly got societal engaged, especially in the environmental area. My first internship as a chemical engineer was at DSM. I could have done my PhD in quantum chemistry, but instead I applied to Shell. They wanted to employ me as a manager, but not as an engineer to do calculations. That proved to be prophetic.

## Out of Africa

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My first job was doing technology assessment. You look at the environmental, economic, societal and psychological aspects of technology. That was a good match for my interests and social involvement. I decided to do my PhD research in a developing country. When I came back from Africa, I mostly gave lectures and did research for industrial development in developing countries. A few years later, I became the director of the Eindhoven Center of Technology for Sustainable Development (TDO). That center has grown into the Eindhoven Energy Institute.

This is really my university. I like TU/e because I’ve experienced so many disciplines here. When the plans were being made for the Bachelor College, I was put forward as a candidate to act as coordinator. And now, contrary to what I thought before, as Dean I’m a full-time manager. To be honest, I’m very happy in this job. The recent recognition of being appointed as professor adds an extra dimension to that.

## Shared passion

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Informality is a characteristic of TU/e. You're hardly ever asked what your job is, or your place in the organization. The important thing is what you do, and what you're passionate about. That was already the case at the Eindhoven Center of Technology for Sustainable Development. Environmental Science didn't become a separate discipline, but has been integrated into all the programs. The Master Sustainable Energy Technology is the first interdepartmental program dealing with energy, in which physicists, mechanical engineers, chemists and electrical engineers all work together with social scientists on education and research. This kind of collaboration can only succeed if it has the right drive and awareness of a greater interest. You see these sorts of collaborations a lot at TU/e, also at the cutting edge of healthcare and biomedical engineering, and in the field of mobility. In essence, it's about relevant and highly responsible scientific research. But where people find each other is in a shared passion for finding solutions for the big challenges of our time.

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*“The important thing is what you do, and what you're passionate about”*

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## At the cutting edge

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Since the start of the Bachelor College, we've shown much more clearly that TU/e is also a place where you can get involved with health, environment, energy or mobility during your education. The message is: choose the program that's the best match for what you want to do. We've now made the idea of following your passion, that up to now has always been in the background, much more clearly visible, and we've made it an essential part of the educational programs. And in contrast to that past, you no longer first have to do a long introductory phase before you find out in your Master's exactly why your program is so interesting and relevant.

We now see that dreams lead to visible results. An awareness of societal problems can very successfully be combined with fundamental research. Exciting things happen at the cutting edge between disciplines.”

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*“We now see  
that dreams lead to  
visible results”*

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**Fiona Jongejans**

Industrial Design Student

# “We can be proud of our modesty”

**After she gained her bilingual pre-university education, Fiona Jongejans (1989) decided to study Industrial Design at TU/e. As a master’s student she’s active on a lot of fronts: she’s crazy about skiing and blogs on her website about all kinds of design-related subjects. She gets annoyed about the hype of calling just about everything ‘social design’.**

“After high school I was looking for a bachelor program in which I could use both my brains and my creativity. At one of the Industrial Design ‘Student for a day’ events at TU/e I immediately noticed the friendly and open atmosphere and the small scale approach that gave the department an accessible feel. It was all about developing relevant competences. After an hour, I’d already decided to choose Eindhoven.

## Sustainable future

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I did an internship at the design studio of Cindy van den Bremen, who does social and cultural work in urban areas. How can you connect people and how do you work together? My graduation project is about communication between inhabitants and housing associations. As a designer, I see it as a challenge to work in the social field, and to link that to a sustainable future. It’s good to see that more and more people are choosing a sustainable lifestyle. I don’t like all the capitalist consumerism that surrounds us. But I think the program could have a stronger focus on sustainability as a theme.

## Vision and goals

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I’ve had the chance to do and experience different kinds of extracurricular activities during my studies. I’ve organized study trips with other students, been on the board of my study association, I’ve been in the University Council and worked for Studium Generale, the TU/e arts and culture society. I enjoy working together on creating visions and setting goals. My master’s phase started with a three-week project in Beijing. With a team, we designed a lighting installation based on the stress of pupils at Chinese primary schools. After that we worked together in Ankara, Turkey, with students at the local university on an installation that was also exhibited during the Dutch Design Week. I find

it inspiring to learn about different cultures and to find the added value that you can offer as a designer.

## Strong community

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I've learned a lot from working together in committees. I tend to be rather direct, and that doesn't always match the mentality here in Brabant. I have high expectations of people, and I'm always doing things at top speed. But I've learned to give people more space, and in a team setting, to look out for the individual strengths of others. At TU/e, I have a network of active students around me. I really like the interaction in such a mixed group of people from different departments. You meet up in Auditorium, in the Sports Center or in the city.

I think we form a very closely-knit community at TU/e, but that's not always visible from the outside. It's really special. I find it very easy to get in touch with professors and coaches. There's none of the usual hierarchical feeling. I often hear the lecturers say that they're also here to learn. However good they may be, you'll never hear them say that about themselves. Everyone is so modest, with a lot of integrity, and nobody boasts about their successes. That's something we can be proud of – I think it's a very good characteristic.

## Creativity makes the difference

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Right from the start, I noticed that there's a high level of collaboration with industry in our department. Almost every student project is a company assignment. That makes you more realistic: designing something for a client is very different from just making something that you like yourself. I recently saw a documentary about the 'Techmens', the technology-assisted humans of the future. What will be the distinguishing features

of people when we have so much technology that we hardly need to do anything for ourselves? The answer was creativity! Computers will never be able to take that over from us. And I think creativity will also make the difference for future engineers.

## Entrepreneurship

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Eindhoven is an easily accessible and friendly city, and just like TU/e, it has community spirit through and through. There's a lot going on, but it's still easy to find your way around. There's also a lot of activity in Amsterdam, but it's much more chaotic there. I think I'd like to work here after I graduate. But I'll just see what comes along at that time. I'm ambitious, but my work is part of my life and there are lots of other things that I also find important. I see some interesting changes in society. A lot of young people are starting their own businesses and becoming entrepreneurs. I'd also like to work for myself when I have my Master's degree. I've already applied for a VAT registration. I think consultant isn't a very attractive word, but I would like to go into the advisory direction as a designer."

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*“I find it inspiring to learn about different cultures and to find the added value that you can offer as a designer”*

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**Mr. Jo van Ham**

Vice President of the Executive Board

# “Strong connections with industry and the community”

**Jo van Ham (1953) studied Law at Radboud University and graduated with a degree in criminology and criminal law. He can look back on a long career at the Ministry of Education, Culture and Science. “I learned about TU/e through my professional network, and that immediately ‘clicked’. In the first discussions, I soon realized it was a friendly university community, with a lot of attention for people. It combines informality with a focus on performance and a high standard of quality.”**

“I think TU/e is a real engineers’ university. Here, it’s all about science and engineering. TU/e is one of the specialized universities, that’s the niche we’re in. We follow a thorough and concrete approach. When I had only been working here for six months, I saw that although the university had an excellent performance level we had no clear vision for the future. So we set up the ‘TU/e Strategy 2020’ under my leadership. That was exactly the right job for me.

We looked at a lot of options to find the right future scenarios. And we held many inspiring round table discussions with people from TU/e and external stakeholders. I’m still proud of this long-term strategy.

## Social and economic profile

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TU/e has strong growth ambitions because there’s a significant shortage of engineers in the Netherlands. The educational program has been renewed, and that makes it even more attractive for young people with scientific talent. We’ve also worked to create a clearer social and economic profile for the university, and in that context we’ve chosen three recognizable societal challenges: energy, health and smart mobility. We’re now making good progress with the development of the campus into the TU/e Science Park: an inner city campus where students, researchers, lecturers and entrepreneurs can meet and inspire each other. For me, it’s a great challenge to translate this strategy into concrete actions.

## Meeting and learning from each other

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I like to see the enthusiasm for young people. Everyone who works here has a drive to help students, and to contribute to their education and support them in their academic careers. But

there's also a lot of enthusiasm among the young people themselves. A special aspect is the intensive contact between lecturers and students. Meeting each other and learning from each other on the campus gives me the inspiration to work on the redevelopment of the TU/e Science Park. I think meeting each other is an essential starting point that we want to achieve in our buildings. The renovated MetaForum building, the central meeting place on the campus which houses the library and other student facilities, is currently the best example of that. Flux, the new accommodation for the Departments of Electrical Engineering and Applied Physics, with its shared services, will do the same thing. This was also what led me to develop the traffic-free green central area on the campus: a place where people can meet each other. And if you look at the history of TU/e, that's exactly the idea that was put into practice with the network of walkways. We've worked on building a campus that people experience as coherent and unified, both inside and outside. We're extending this green central area into an innovative, open city park in Eindhoven."

## Dutch Technology Week

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Out of all the universities worldwide, we have the closest collaboration with industry. We're number one in collaborating with researchers from industry. We have close links in technology and innovation with our industry partners. What I like to work on with enthusiasm and pleasure is building connections between TU/e and the city of Eindhoven and beyond, in fact the whole of the Brainport Eindhoven region. For example, a few years ago, we combined forces to set up the Dutch Technology Week, in which companies and the university open their doors to present the hidden treasures and the wonders of technology and innovation to the public at large, and especially to young people.

## Student life

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We're an open, easily accessible university. What I hear from students is that – in addition to contact with professors and researchers – they are very proud of the atmosphere here, the accessibility and the student life. And that's something we work on with pleasure. For example, through the excellent student initiatives like the soccer robots and solar car Stella. I'm especially proud of our student and study associations and also the sports and cultural societies. I'm not afraid to say that student life at TU/e is among the best in the Netherlands. And we don't just try to create links with Eindhoven by bringing the city to the TU/e Science Park – we also take the student associations to the city. For example, the Eindhoven Student Corps is now based in an attractive building in the city center. I think it's great to have the opportunity as a board member to work on that 'TU/e student life'."

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*“We’ve worked on  
building a campus that  
people experience as  
coherent and unified,  
both inside and outside”*

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## Holi: festival of colors

Holi is a Hindu festival in which participants dance, feast, sing and throw colored powder at each other. Holi is celebrated each spring on the TU/e campus. Different nationalities from the whole TU/e community get together and celebrate during this colorful spectacle.









## Studium Generale

In addition to providing scientific education, TU/e also regards social, intellectual and cultural activities as important. For this reason the university's arts and culture society Studium Generale (SG) organizes a program of activities including lectures, concerts, exhibitions, theater and film shows and workshops. SG also strengthens the university's international community and cultural role in the city and region. Events are often held in the Gaslab, a former laboratory on the TU/e campus which has been converted into a theater. As well as film shows in the Zwarte Doos movie theater on the campus, a number of films are also shown outdoors each spring.

## Dynamic student city

For years 'De Bunker', near the TU/e campus, was a symbol of student life in Eindhoven. As the complex is going to be closed in the near future, student societies are increasingly finding their way to the center of Eindhoven. One example is the move of the Eindhoven Student Corps to a stylish villa in the inner city.





## Meeting and having fun at the Intro

Sports, games and tons of other activities, all meant to make each other's acquaintance and to get to know Eindhoven and its university: this is the annual student introduction at TU/e. Thousands of new students, from freshmen to post-grads, and from all corners of the globe gather at TU/e to learn about the university and the city. Not only do they discover what awaits them academically and what information is to be found where, but there's plenty of room for fun stuff as well. The week concludes with a traditional cantus: thousands of students singing at once. The week is a good starting point for new students at TU/e. It prepares them for their new adventure.







## Eindhoven 'City of Light'

Each year thousands of visitors take a look at the surprises that the Eindhoven light art festival GLOW has in store. GLOW is a meeting place for light, technology and art. The TU/e Intelligent Lighting Institute takes part in a number of light projects. Waves, a joint production with the spinoff Sorama, is an interactive installation that visualizes sound waves in the form of light. Visitors are challenged to make their own sound. Depending on the location, frequency and volume, they are surrounded by thick, thin, fast, slow, large or small circles. It proved to be a great, dynamic setting for the Tunas, the student society for Spanish folk music.







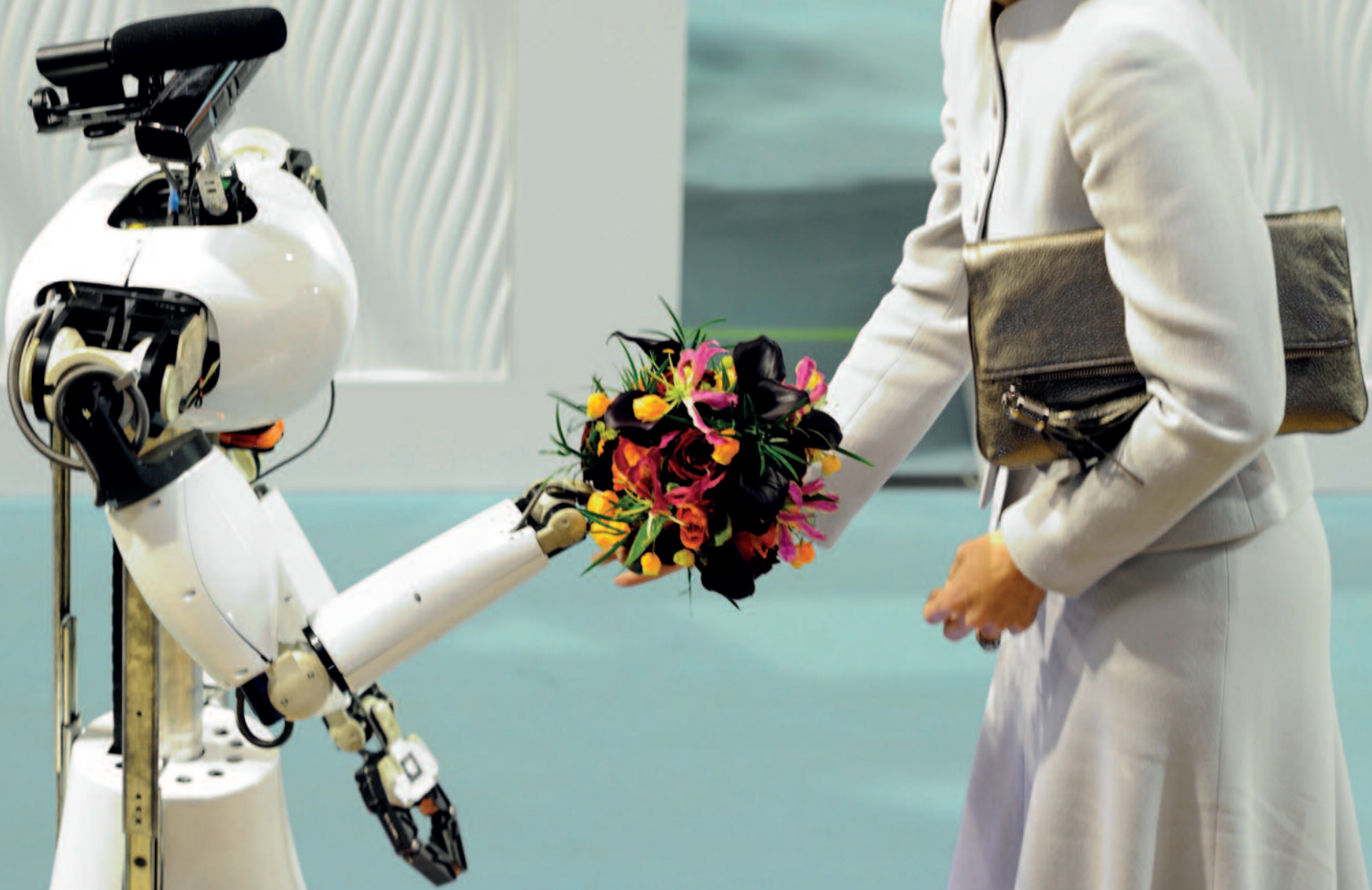
# Dies Natalis

The Dies Natalis – or Foundation Day – is held each year in April in a church in the city center. The procession of professors, all wearing their togas, is a striking sight in the city streets. The people in the city can also enjoy the TU/e's festivities during the lustrum anniversary celebrations. For example during the 55th anniversary of TU/e when the popular Dutch singer Ilse de Lange gave a concert on the Market square in Eindhoven.



## Royal visit at TU/e

TU/e has long been the subject of royal interest. Queen Juliana of the Netherlands opened, what was then, the Technische Hogeschool Eindhoven in 1956. And in 2006, Queen Beatrix attended the university's 50th Dies Natalis or Foundation Day. Her Majesty Queen Máxima was presented with a bouquet by TU/e care robot AMIGO during the World Championship Robot Soccer in the Netherlands. The queen enthusiastically watched a demonstration match of the TU/e soccer robots against the Chinese team.





## 'De Tuimelaar' daycare center

In addition to students, staff and scientists, you'll also find children at play on the TU/e campus. Youngsters aged up to four are everyday 'visitors' to 'De Tuimelaar', the daycare center on the TU/e campus. Parents who work or study at TU/e or nearby can entrust their children to the daycare center.



**Prof.dr.ir. Antonie Meijers**

Professor of Philosophy and Ethics of Technology  
and Distinguished University Professor

# “Perceptio agitat mentem: perception moves the mind”

**Antonie Meijers (1953), trained in mechanical engineering and philosophy, has been professor of Philosophy and Ethics of Technology since 2000. He is the author of the university’s long-term vision on education entitled Engineers for the Future (with Perry den Brok). He has also been actively involved in the design and implementation of TU/e’s Strategy 2020 and the Bachelor College. He is the chair of the advisory board on scientific integrity. In 2013, Antonie Meijers was appointed as Distinguished University Professor. “My strong commitment to an engineering education that involves more than just technical subjects comes from the enormous influence that engineers have. Just look around you - you’ll find the fingerprints of technically-trained people on almost everything. They determine the quality of our lives to a large extent.”**

“The School of Innovation Sciences, of which I am vice-dean, is home to most of the university’s social sciences and humanities. It is located in the IPO building, named after the former Institute for Perception Research. On the first floor hangs a bas-relief of prof.dr. J.F. Schouten, professor of Perception and Information Science and the first director of the institute. It states: *perceptio agitat mentem*: perception moves the mind. That was the first sentence of Schouten’s inaugural lecture in 1958, and a deliberately chosen variant of the TU/e motto *mens agitat molem*: mind moves matter. The phrase is meant to emphasize the importance of perception for human action and decision-making. Perception, however, is in our times strongly influenced by and shaped through technology. We see in ways we could never before (television, Internet, MRI, drones, etc.). This has a large impact on us. Schouten, therefore, believed that the education of academically-trained engineers should involve the human factor. He recruited research staff from a wide range of disciplines, from linguistics to physics and from psychology to electrical engineering. Under his leadership, the IPO grew into a leading international institute.

## Linking two worlds

I see myself as an advocate and guardian of this tradition. I was first trained as a mechanical engineer in Delft, after which I studied philosophy in Utrecht. I gained my PhD in philosophy in Leiden and finally became professor of Philosophy and Ethics of Technology in Eindhoven. I’m convinced that you’ll educate better engineers and you’ll get better technologies if you make sure that attention is given to the human aspects – to the human and societal context in which these technologies have to function. That has to be learned as an academic skill right from the start. It is not a ‘nice-to-have’ option that can be added later, but rather an

integral part in the development of an engineer's thinking habits or practices. These practices must take into account all relevant aspects, including non-technical ones, when developing technologies. This kind of integrated outlook has been one of the goals right from the founding of TU/e. At that time, it was a direct result of the Second World War and the important role that technology played in it. That goal has lost nothing of its relevance since then. If you ask me what the DNA of the university is, then the integrated outlook is one of the core aspects through which we can distinguish ourselves as TU/e.

## A world designed by engineers

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The new Bachelor College marks a revival of that old ideal. In the past, the social sciences and humanities at TU/e were all too often considered as separate from technology. That was not very successful. Today, we aim at integrating them, most prominently in the so-called USE component of the Bachelor College, for which I am responsible. USE stands for User, Society and Enterprise. We have developed, among other things, course sequences on the quality of life and technology, on decision-making under risk and uncertainty, on the future of mobility, and on technology entrepreneurship. These course sequences are linked to our research. Take, for example, our NWO research project 'Medical Trust Beyond Clinical Walls'. It investigates the role of e-health technologies that enable older people with health problems to continue living at home. The project involves questions related to quality of life, but also questions like: can these people really *trust* these e-health technologies, and who's responsible if something goes wrong? Such an example also shows that the role of engineers has fundamentally changed over time: our future personal and social world is to a large extent explicitly *designed* by engineers.

## Small university, big opportunities

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Our largest contribution to society is probably the more than one thousand academically-trained engineers that TU/e delivers each year. They find employment not only in industry, but also in government organizations, hospitals and high schools. But we do more. With so-called strategic innovation areas (health, smart mobility, high-tech systems, etc.) TU/e intends to strengthen the collaboration between the departments and to exploit the multidisciplinary potential of the university for the benefit of society and industry. TU/e is a small university, and that offers big opportunities. Distances are small, in both physical and organizational terms. We can and should be a real network organization, in which each group acts as a hub linked with other groups. We are moving in that direction. One of the important effects of the Bachelor College is that departments have to work together more closely. Many of the course sequences offered in the elective component of the Bachelor College are multidisciplinary. For example, in the course sequence 'Sports, Technology and Behaviour' students learn how sports performance can be improved by combining an understanding of Biomedical Engineering and Psychology with Electrical and Mechanical Engineering. If lecturers work together in such an educational project, they will be able to build further on this in their later research. And that will uncover many of TU/e's hidden treasures."

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*“Our future personal and social world is to a large extent explicitly designed by engineers”*

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**Ir. Maarten Beelen**

Engineer at PRECEYES Medical Robotics

# “Technology has to contribute to well-being”

**He once gave a presentation at TEDxBinnenhof. But in February 2013, mechanical engineer Maarten Beelen (1986) was even invited to take the stage at Amsterdam’s popular music temple Paradiso. During the ‘Wonder of Eindhoven’ festival he won the audience’s enthusiasm for the PRECEYES surgical system. He always had a love for technology. “Finding synergies between science, technology and applications. That is a typical quality of the TU/e.”**

“In high school I was already fascinated by technology. My friend and I were sitting in the back of the physics class, often with our feet on the desk, philosophizing a bit about magnetism or gravity. That was how we learned the subject. The teacher didn’t have a problem with that because we always got good grades. In school I already liked applying knowledge in practice. And we were totally absorbed in building a medieval catapult. I liked the atmosphere at the TU/e open day, and I was able to identify with the people here. I met technologists who were proud of their technology.

## Motivated by the subject

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During projects I’ve always been guided by what I liked most at the time. I found design-based learning more motivating than following courses. I sometimes worked until late in the evening to finish an assignment as well as possible. I worked in the Polymers Group led by professor Han Meijer on building a bioreactor for growing autologous heart valves – a pump system in which you mimic the pressure and flow of the blood circulation in the heart. I found this a really motivating subject. One day, I put the whole system on a trolley and waited at professor Maarten Steinbuch’s door until he came out, so I could get him excited about the project. After that I was able to do my graduation project in his group.

## Useful for people and society

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I wanted to graduate in a subject in which my own work would be clearly visible in the system we had built. I had a list of the points that I wanted to achieve. Technology has to create added value and contribute to well-being. That may sound abstract, but I really wanted to achieve something that would benefit people and society - not just develop a game or doing something for defense. My graduation

project was based on work for Sofie, a robot for abdominal and chest surgery. I focused on providing haptic feedback – enabling surgeons, through the robot, to ‘feel’ what they are doing in the body tissue during an operation. This would allow them to recognize the underlying structures, such as nerves or blood vessels, without causing any damage.

## Clinical proof

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My dream was to start a company together with a small, motivated team. It was clear that it would be difficult to market Sofie because there is already a commercially available alternative. But at around the same time, Thijs Meenink earned his PhD with a robot for eye surgery. A smaller device, but with the same design disciplines for precision and similar characteristics to Sofie. Together with Thijs and Gerrit Naus I then started our company PRECEYES. We developed a prototype with which we showed that surgical procedures are possible that can’t be performed by hand.

You can’t sell precision by itself: you have to enable a specific procedure, or improve a procedure, working together with surgeons. We’ve taken big steps forward in the technology. We’re supported by TU/e, but at the end of the day you have to find a strategic match with a company or with a ‘business angel’ who’s prepared to make the investment. Now we’re working hard to be the next large high-tech company in the Brainport Eindhoven region. The work we’re doing now is focused on providing clinical evidence. We’re now evaluating potential ‘killer applications’: where can you really create added value for patients with the high precision of the system? We are working together with opinion leaders in retinal surgery from Switzerland and the USA.

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*“My dream was to start a company together with a small, motivated team”*

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## Open your eyes

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I’m sometimes faced with the question of whether I’d like to do a PhD. But I’d rather gain a new success each week. I like working in a team. Inspiring each other, sharing things. I think TU/e people are strong academically and make good engineers. A friendly atmosphere and the willingness to work together are part of our character. We’re all focused on the same goals. You should always be proud of your work and be ready to talk about it. That’s what I like to do, whether it’s a meeting for prospective students, a TEDx presentation or on TV. You just have to make sure you don’t drown out other voices. Open your eyes and make deliberate choices. What I’ll be doing ten years from now? I’ll worry about that when the time comes. I prefer to live in the moment, follow my heart, choose purposely and not get stuck in structures in which I accidentally find myself.”

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*“You should always  
be proud of your  
work and be ready  
to talk about it”*

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**Prof.Dipl.-Ing. Christian Rapp**  
Professor of Architectural Design and  
Urban Cultures

# “Feet on the ground, head in the clouds”

**Christian Rapp (1962) started his career as a bricklayer before studying architecture at the Technical University of Berlin. During his studies, he worked for architecture firms such as the Office for Metropolitan Architecture in Rotterdam led by Rem Koolhaas. “I’ve lived in the Netherlands since 1994, and I gradually found that I wanted to combine my working practice with teaching.” He has been a professor in the Built Environment department at TU/e since 2007.**

“I already dreamt of becoming an architect as a child. The idea of designing a building and then seeing it rise at full size on-site really appealed to me. My architectural studies meant I had to move from Munich to Berlin. This was seven years before the fall of the Berlin Wall. I saw the fundamental changes in the city at the beginning of the 1990s as a result of the huge number of new building projects. By that time I had my own architecture firm and I got to know every aspect of the business, from architecture to urban design and everything in between.

## Master plan for the campus

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I’m interested in how the academic and practical worlds can enrich each other. My involvement in the development of our campus means the activities of my chair have broadened. I was also asked to develop the master plan for the TU/e Science Park. The plan is based on a number of spearheads such as building on the cultural history of the campus, and keeping alive the spirit of post-war architecture. We also want to open up the campus to other users by designating areas for specific purposes such as residential, higher vocational education institutes and industry. The campus will be developed further into the TU/e Science Park, combining high-tech research with education. And at the same time, we want to further develop the existing ‘green belt’ into an urban park – a green heart of the campus that’s a good place to be.

## The best of both worlds

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The great thing about architecture is that you can combine the best of both worlds. An architect is involved on-site with both feet on the ground, and at the same time, has his head in the clouds in creating a vision of the built environment.

Here in Eindhoven we educate engineers for the future. Their profile is different from what it was in the past. In my day, we had one department that educated architects, another for civil engineers and yet another for urban planning students. At TU/e, we talk about ‘T-shaped engineers’ as the ideal – engineers who combine in-depth knowledge of their own specific disciplines with an overall understanding that extends across related fields. Architects often have that combination, but in many cases we still struggle with the apparent contradiction between generalists and specialists.

## Campus DNA

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In the culture we’re aiming for, we want to move away from island thinking. The question we ask ourselves is: what do we have in common and what can we do together? Do those connections have a follow-up in the built environment, through which we can further strengthen the resulting collaboration? That’s why we also value our system of walkways that we call the DNA of our campus. While walking from a lecture in the Auditorium to the Metaforum you meet people who work in other fields, and with whom you can maybe come up with new solutions.

Connections between different wings of a building lead to communication and informal encounters. That’s how the architect becomes the hardware supplier for community building. But even before those social processes can start, you have to create the right conditions. You shouldn’t need to force collaboration between different disciplines. It only works if there’s a purpose behind it – if you can connect with each other through what you’re working on.”

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*“Connections between  
different wings of a building  
lead to communication  
and informal encounters”*

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## From 'desire path' to main route

The TU/e campus is located close to the center of Eindhoven and is just a five-minute walk from the railway station. The gently undulating 'Limbopad' forms a part of the link between the station and the green campus. People who don't come from this area need to know that 'Limbo' is a popular name for someone from Limburg – the southernmost province of the Netherlands. This path's name refers to the large numbers of students from Limburg who travelled to and from the university by train. By walking this route they created the original, unofficial version of this 'desire path'.





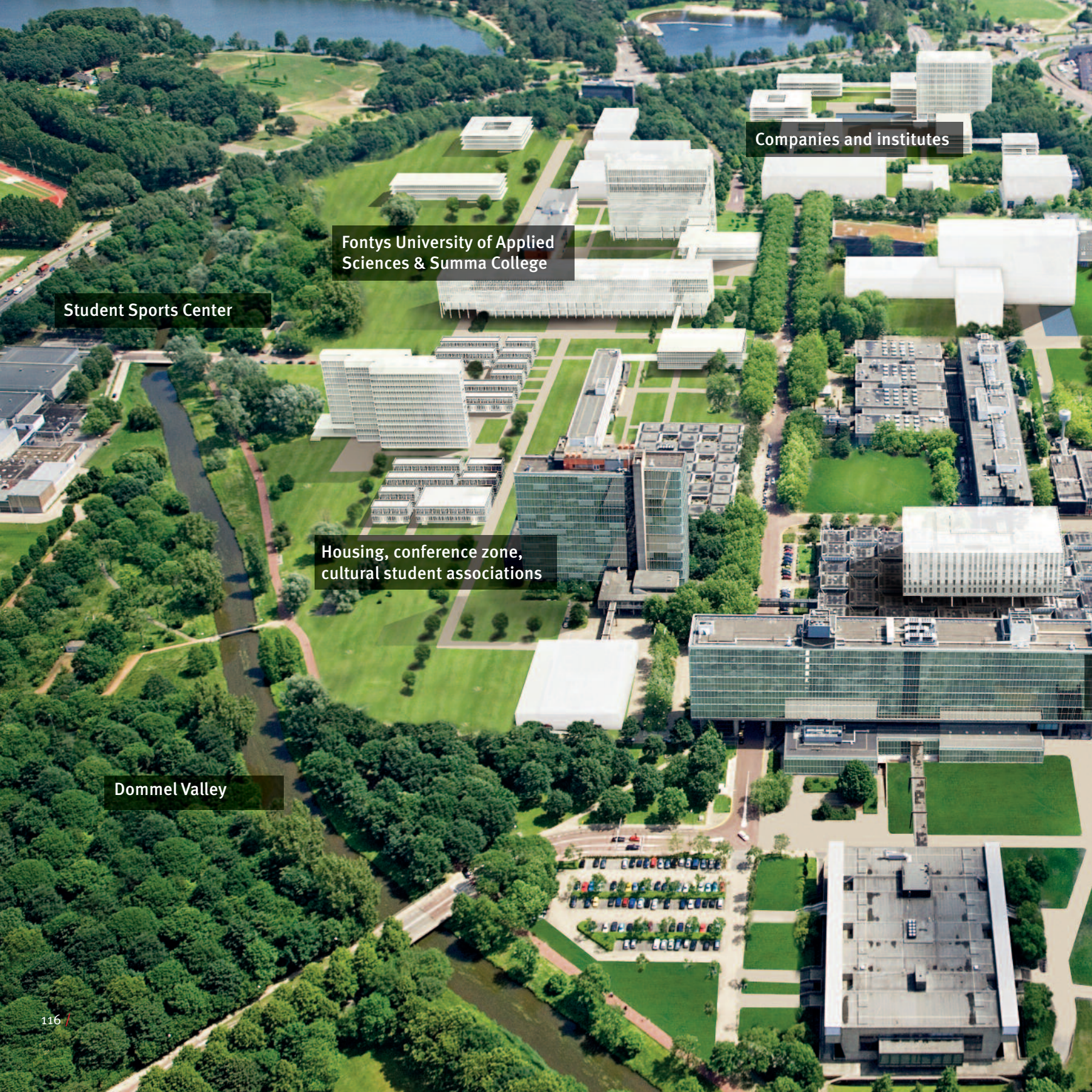


An aerial photograph of a university campus. The foreground and middle ground are dominated by a dense forest of trees with vibrant autumn foliage in shades of green, yellow, and orange. A paved path curves through the trees on the right side, leading towards a small pond. In the background, several university buildings are visible, including a prominent church spire and a large, multi-story residential or administrative building. The sky is blue with some light clouds.

## Green university

TU/e is one of the 'greenest' universities in the Netherlands. The campus forms a city park in the center of Eindhoven. Located in the undulating Dommel valley: a cultured landscape through which the river Dommel meanders. But for TU/e, 'green' also stands for sustainability. For example the university has the largest thermal energy storage system in Europe. Use of the charging stations for electric cars on the campus is compensated by solar panels. TU/e has big ambitions for sustainability: in the near future the university intends to achieve both climate and energy neutrality.





Companies and institutes

Fontys University of Applied Sciences & Summa College

Student Sports Center

Housing, conference zone, cultural student associations

Dommel Valley



Compact university  
campus TU/e

## Development of TU/e Science Park

By 2020, TU/e Science Park will be an even more attractive meeting place for students, researchers and entrepreneurs, with excellent facilities of all kinds. It will be an open, green site that serves as a hotspot for technology education, with lots of innovative activities. A traffic-free green central area runs across the park, the new buildings are sustainable and the campus has the look and feel of a city park located close to the center.

This image is an impression based on the TU/e Science Park Vision



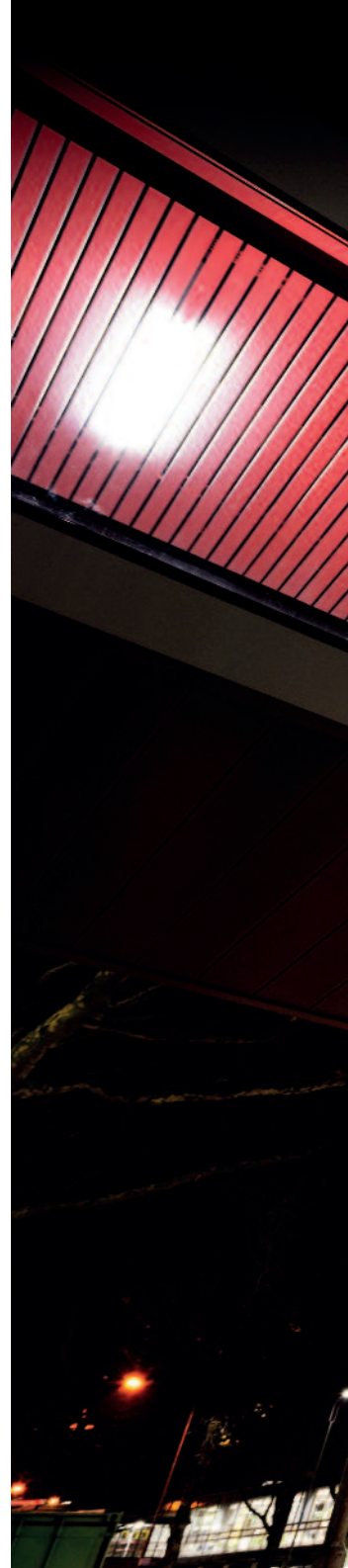
# Far-reaching partnership in Flux

The new Flux building is home to the Electrical Engineering and Applied Physics departments. Bringing these two departments together in the same building is expected to strengthen the collaboration between their researchers and students. It also allows the departments to make optimum use of the shared educational space and facilities and the nearby laboratories.

Flux is the most sustainable building on the TU/e campus, in terms of both energy consumption and the use of building materials that can be recycled after use.










## Walkways as DNA of the campus

In a distant past, it was filled with cast-iron machines and mechanical engineering students. But now, the former 'W hall' building is the new, central meeting place on the campus, called MetaForum. Elevated walkways connect MetaForum with the other buildings, literally and figuratively connecting the different departments. The walkways promote collaboration between the different disciplines, and facilitate communication and informal meetings within the TU/e community. Architect Sam van Embden designed this system of elevated walkways in the 1950s, and it's still an integral part of TU/e's DNA.







## MetaForum: the beating heart of the campus

A former workplace at the campus was transformed into the new MetaForum building with the latest educational facilities. The building is home to the new university library and the student service desk, and offers working accommodation for more than 900 students. MetaForum forms a vital link on the campus: the central covered hall provides space for work and leisure, and serves as a meeting place for the TU/e community. Over the covered hall is a five-storey building that houses the Department of Mathematics and Computer Science.



**Prof.dr.ir. Maaïke Kroon**  
Professor of Separation Technology

**“I’m really enthusiastic about imitating nature in separation processes”**

**As a young girl, Maaïke Kroon (1980) found school boring and she wanted to be an astronaut – but with the guarantee that she would return safely to Earth after her mission. She finally decided to study Chemical Engineering at Delft University of Technology. She earned her PhD when she was 25. With her appointment at TU/e at the age of 29, Maaïke Kroon became the youngest female professor in the Netherlands. Her ambition is for her group to grow into an internationally-renowned research group.**

“In my fourth year I did an internship in Tokyo, in the Toshiba research department. I was clearly told what my job was, and I had to stick to it, even if I found something else that was interesting. That made me decide not to go into industrial research. When I was around 22, I started to think I’d like to become a professor. I thought it would be great to decide for yourself what research you want to do, to follow your curiosity and to have the freedom to study what interests you most. Being a professor is a busy job, especially because I’ve been able to fulfill another wish: becoming a mother.

### **My own ideas**

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As the professor of a new group I give a lot of lectures. Fortunately, I always liked explaining what I’m working on. I’m currently supervising eight PhD candidates. That’s about the maximum number, until an assistant or an associate professor is appointed to my group. As a professor, you’re increasingly expected to gain your own research funding. I have no trouble writing articles and research proposals. When I started here, I was able to write my own applications for grants, and I could build my research group from the ground up. That’s quite exceptional, and it means that all the work we’re now doing is based on my ideas.

### **Smarter separation methods**

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My main research theme is energy-efficient chemical separation processes. There’s a lot of interest in my field because many chemical companies use separation technology. That accounts for 60 to 80 percent of their costs, so finding smarter separation methods can save a lot of money. For example, we’re doing research into desalination, biogas purification and biomass fractionation, as well as into the use of natural solvents in different separation processes. These

are substances that are produced in plants, and can be used as solvents for biorefinery processes. I think there are a lot of opportunities in the coming years, not only for collaboration with the chemical and energy industries, but also in areas like water purification, the paper industry and the life sciences. My research currently has a strong focus on biology. I'm really enthusiastic about imitating nature in separation processes. I like the freedom to do research into subjects like these.

## Ambitious

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I had a great time in Delft, and after that I was given the opportunity in Eindhoven to start as a professor. TU/e is an ambitious university. Taking this position was a strategic move for me, because Process Technology is growing here. It means working together with different kinds of people. TU/e has few intermediate layers, which means it's easy to approach people. If I have to present an application for research funding, I practice it first in front of my colleagues, and then I just might find the dean is also there. The opportunity to start my own group is also related to the size of the university – it would be much harder to do this at a larger university.

It gives me great satisfaction when my students are successful. If we're awarded a grant, or if a graduating student wins a first prize in an international competition, the whole group goes out for a drink in the evening or for a meal. We inspire each other to excel. You can really see people grow when they do their graduation work here."

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*"It gives me great satisfaction when my students are successful"*

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*“We inspire each other to excel”*

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**Prof.dr.ir. Wil van der Aalst**  
Professor of Information Systems and  
Distinguished University Professor

# “The multidisciplinary Data Science Center represents what TU/e wants to be”

**Wil van der Aalst (1966) is one of the world’s most-cited computer scientists. In December 2013, TU/e launched the Data Science Center Eindhoven, a new research institute under his scientific leadership, in which TU/e departments and companies work together. Being a data scientist is often referred to as ‘the sexiest job of the 21st century’. “The amount of data is growing at an incredible rate. Ninety percent of all the data available worldwide was produced in the last two years.”**

“I started working in research by chance. I really wanted to do something practical with computers, but in the early 1980s computer science was just starting, and a lot of people wanted to study it. I studied Computer Science at TU/e where I got my Bachelor’s and Master’s degrees in four years. I wanted to start earning money as quickly as possible, but first I had to start military service. I didn’t want to do that so I started a PhD program. That’s when I first became fascinated by research in this great field, and it’s never let me go since.

## Scientific impact

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I’ve been working here for 25 years, and in that time I’ve built up an extensive international network. What I like about TU/e is that it’s down-to-earth, and that there’s a focus on in-depth research. I like being involved in the Champions League of research. What’s important to me is developing new and exciting research lines, and not the number of publications I can get in specific journals. I think citations and impact scores are more important than the number of papers in particular journals. Our software is used at many places around the world, which is quite remarkable for the specialized tools we have developed. That’s what scientific impact is all about – having an influence on your field and advancing the state-of-the-art.

## World leader in process mining

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Currently, we are focusing our research on process mining. That means automatically building process models based on event data, so you can see where problems arise. The data can come from many different sources: patient information from hospitals, mortgage data from a bank or logistics information from an airport. Using raw data we can automatically pinpoint the bottlenecks in

complex processes, or we can use the data to predict the lifetime of high-tech systems.

Process mining not only shows us the root cause of a problem, it also allows us to predict failures and delays, and how the process can be improved. At TU/e, we're the world leader in process mining.

## Data changes our relationship with the environment

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Governments, industry and banks are increasingly interested in big data. It gives us the chance to show what TU/e can do. The working field of engineers is changing drastically. Huge amounts of event data serve as a 'mirror' for scientists, and allow us to carry out new reality checks. You can't do your job any longer without using such data. Data science plays an important role in societal themes like sustainability, healthcare and mobility. The car of the future will be full of sensors, and in constant communication with the driver and its environment. People are also increasingly going to generate their own energy, and will be able to decide for themselves when and how they can use their appliances as energy-efficiently as possible. The only way to keep healthcare affordable is through smart use of data. I consider myself fortunate that I was able to contribute to the transition of my discipline to more data-driven research. We can now test our hypotheses and methods using real data, and no longer have to use just artificial models or simulated data. I think fundamental research and contacts with industry aren't contradictory. In contrast to what people sometimes think, I believe the interaction actually leads to a strengthening of both sides.

## Dijkstra's algorithm

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In the global Shanghai Academic Ranking, TU/e's Computer Science is in the top 50, and in Europe we're in the top five. As a young university, TU/e may not yet be able to boast any Nobel Prize winners, but we did have a Turing Award winner: Edsger Dijkstra. The Turing Award is considered the Nobel Prize in computer science. In his time, Dijkstra was the founding father of structured programming. In the 22 years that he worked at TU/e, he made a tremendous contribution to the foundations of computer science. His shortest-path algorithm, also called Dijkstra's algorithm, is now used everywhere – for example in navigation systems. We should give achievements like that more exposure.”

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*“That’s what scientific impact is all about – having an influence on your field and advancing the state-of-the-art”*

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**Qurein Biewenga**

Electrical Engineering Student

# “I’d like to get even more international experience”

**In the eighteenth century, his Calvinist forefathers left Groningen to go to South Africa as missionaries. Qurein Biewenga (1990) moved to the Netherlands with his parents in 2007. “That move was a great opportunity to really become a world citizen, and to start thinking outside of the box.” Although he has become a Dutch citizen, he doesn’t intend to miss out on the chance to see more of the world.**

“I really liked mathematics and physics – I wasn’t a top student but I worked hard, did my best and graduated with good grades. My interests are really broad, and I like just about everything I do. We’re all born with talents, and it’s important to make the best possible use of them. On the TU/e website there was a banner that said ‘Society needs more engineers’. That appealed to me. You could call it idealism: I wanted to help the community.

## Good challenge

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My first year went well. But I like challenges, and I didn’t want to choose the easy option, so I also did the Honors program. I met other students who were also looking for a broader program. And if you bring an exclusive group like that together then you might just end up with ideas like building a solar-powered family car. I saw that as a big challenge that would really benefit society. That was a busy time. I still had to get my study credits and I was treasurer of the Christian student association Ichthus. I also worked twelve hours a week at Prodrive, a company that was started by two former TU/e students and now employs more than 600 people. I suggested installing Prodrive’s modular battery management system in our car, which made me the linking pin between the university, Prodrive and the Solar Team. We made a lot of progress, and everyone was excited when yet another big sponsor joined us.

I’ve learned to be open to suggestions from people who know more than you do. I’ve spent three years studying, and what I’ve learned most of all is the process of learning itself. The real job only starts when you have to make something – and you have to face real-world problems and real-world deadlines. We make contacts in industry to find answers to our questions, and we found they were happy to help and to be part of a big project. If there was a company that didn’t want to help, then we

just found another that did. There are plenty of smart companies in this area. Our car was ready on time, and we set off for Australia. But the biggest excitement was when, after the six-day Race to the Sun, we were the winners!

## Shifting boundaries

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What I was most proud of was what we'd achieved together. In South Africa, I told my old friends about the open atmosphere at TU/e. Studying in South Africa is different – you won't find support for a project like the Solar Team. I think the culture here in Eindhoven is more focused on helping each other. People here have a passion for technology, and they're prepared to coach you. What I really notice is the ambition to make progress. It would have been very easy just to stick to the old curriculum instead of doing the Bachelor College. You can also see the same will to get ahead in the rebuilding of the campus. I like renewal and shifting boundaries. A unique selling point of the university is the Brainport Eindhoven region.

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*“People here have a passion for technology, and they're prepared to coach you”*

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## The world is bigger

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I'm now in my fifth year. I'm good at making both short-term and very long-term plans, but in between it's a bit vague. I believe in having a plan for my life. I'd like to get some more international experience, maybe do an internship or graduate in another country. When I start to work, I'd like to do something on a big scale. Working for ASML would be great, but what if you got the chance to set up ASML 2.0? I like travel, and I'd be very happy to work fifty hours a week for ten months and then spend two months traveling. With my international outlook there could well be an 'engineer for the future' in me somewhere. Not limited by just one language or culture, but with a broad outlook. I'm studying Electrical Engineering, but I've read all about the mistakes that were made in the Fukushima nuclear power plant. Engineers for the future aren't limited by their own disciplines. The world is a lot bigger than that.”

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*“You could call it  
idealism: I wanted to  
help the community”*

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## Worldwide experience

Increasing numbers of international students choose TU/e, but the opposite is also true: the university encourages its students to gain experience in other countries. Many master's students opt to spend part of their study periods in other countries. In this way, they learn about different cultures and increase their employment opportunities by doing internships or exchange assignments.

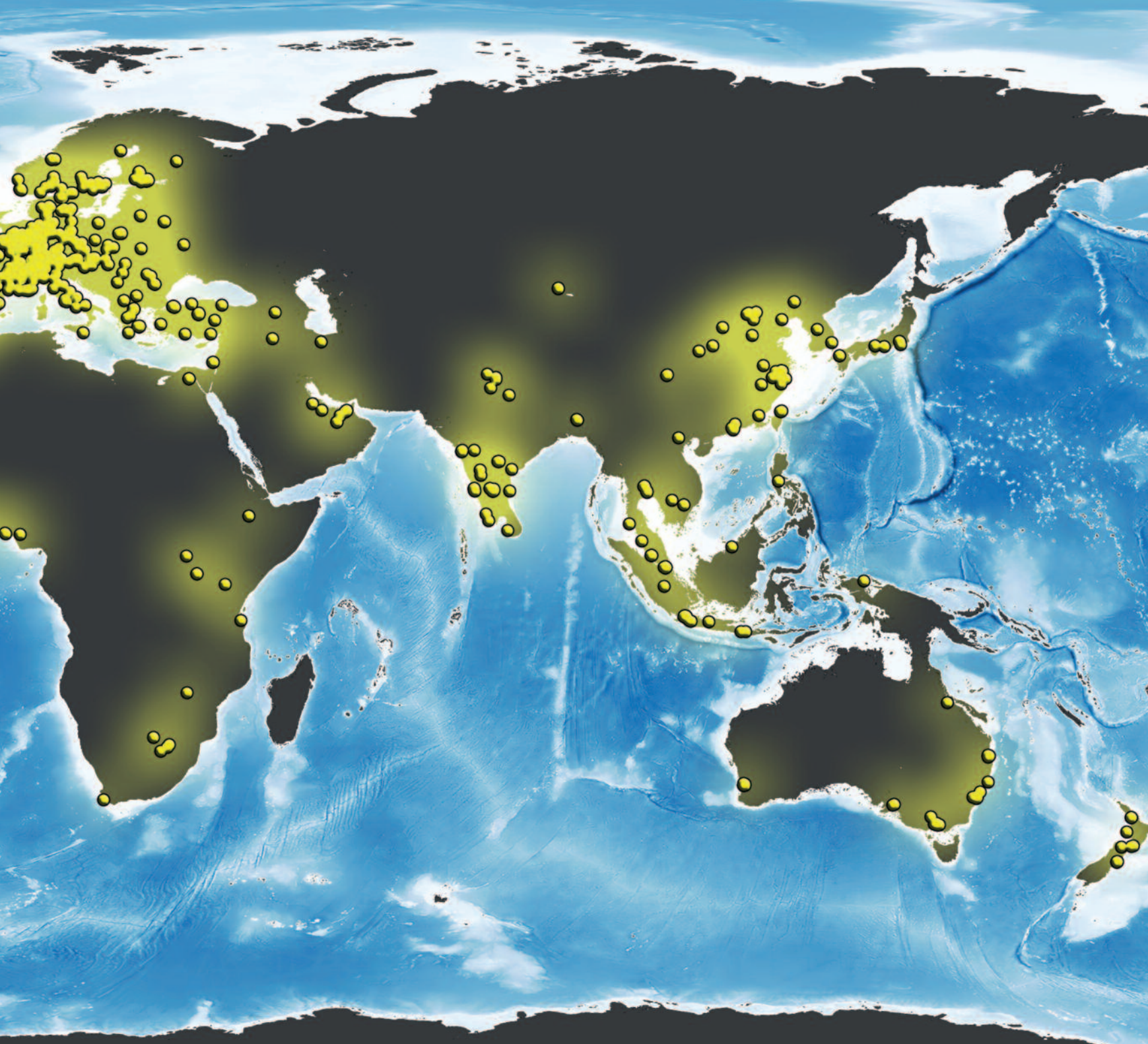
This photo features Pieter Beer, master's student of architecture, in Riga, Latvia.





## Global network of TU/e alumni

TU/e has around 40,000 alumni all over the world and regards them all as important ambassadors. They are role models for our students in their future scientific or industrial careers. To keep in touch with this growing group, the university organizes a wide range of activities, including the Career Café for young alumni, company visits and the annual Alumni Day.





## From study trips to the 'beer-crate bridge'

Each department at TU/e has its own study association that organizes activities for students such as company visits, lectures and study trips. The associations have their own bars on the TU/e campus for meetings and parties. Eindhoven also has a lot of 'general' student associations that are open to all students in the city. The associations are also represented at TU/e ceremonies.

There are all kinds of leisure activities, from galas and sports competitions to special stunts such as building a record breaking 'beer-crate bridge'.







## Europe's biggest student volleyball competition

Sports connect. The Hajraa Outdoor Tournament, Europe's biggest student volleyball competition, has been held on and around the TU/e campus since 1979. Each spring around 450 international teams take part. The Hajraa Eindhoven Student Volleyball Club facilitates volleyball courts and a campsite on the campus. That's where teams from the Netherlands and other countries pitch their tents and celebrate together during the three-day competition.







## Smart training system

Technology and sports go hand-in-hand at TU/e. SmartGoals is an innovative training system for soccer and hockey. It consists of intelligent pylons that communicate wirelessly by using lights to indicate which gate the ball or the player has to pass through. SmartGoals is based on intelligent technology, but can easily be used by anyone to train reaction time, overview and other playing skills. The technology was developed at TU/e and is marketed by the spin-off company SmartGoals.





## World Cup for autonomous soccer robots

In 2013, TU/e organized the RoboCup, the World Cup Soccer for fully autonomous robots, with around 2,500 participants from 40 countries. The 40,000 visitors saw the TU/e soccer team take second place, which meant they didn't quite succeed in holding onto the world title they won in 2012 (Mexico City).

With this championship, the RoboCup series promotes competition between knowledge institutes to accelerate the development of reliable, low-cost robot technology for applications like care and rescue.

Tech United, TU/e's team, includes about 80 students from different departments who work on all kinds of robots.







**Prof.dr.ir. Jan Fransoo**

Professor of Operations Management and Logistics and Dean of the Graduate School

# “Working with industry is truly part of our DNA”

**Jan Fransoo (1965) grew up as the son of a horticulturalist. From the age of twelve, he helped in the greenhouses. In 1984 he started his study Industrial Engineering and Management Science at TU/e. After earning his PhD, he worked as a postdoc at Stanford University. As a keen network-builder, Fransoo is chairman of the International Korfball Federation in his spare time. Until 2013, he was chairman of the Association of IOC Recognised International Sports Federations, which gave him an extensive international sports network.**

“The Netherlands is leading in logistics. In logistics you’re competing at a local level, in this case with Germany or Belgium. If you want to create more added value, you have to be better than the surrounding countries. As a professor of Logistics, I was once approached by the Ministry of Infrastructure and the Environment to help put this discipline on the map as one of the ‘top sectors’ supported by the Dutch government. Once you have a foothold in that network, you’re often approached for specific assignments. Each sector now has ‘top teams’ in which large companies, SMEs and scientists are represented. I’m the representative for science.

## Community of professors

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Since I was a student I’ve been closely involved with the TU/e culture. If I compare Eindhoven with other universities, I can see some distinguishing features that prove we’re doing a good job, and that confirms my feeling that I’m in the right place. In the outside world, I usually tell people that we have around hundred full-time professors. They run the show, because a university is basically a community of professors. A hundred, that’s still a number you can handle, and out of those there are twenty that you come across everywhere. TU/e is really a small, very active and informal network. If you have a question, you can find someone in this network who knows the answer. In general, colleagues are willing to help you and work with you. At other universities, you see that people operate more as individuals. Of course, in Eindhoven, you’ll also find some scientific nomads from time to time – people who regard the university mainly as a place that rents out office space. But loners like that don’t really fit into the way we work here.

## The university of technology for industry

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Another distinguishing feature of TU/e is our industrial network and external focus. Like colleagues from the departments of Chemical Engineering and Chemistry and Electrical Engineering, for example, we're working together with Dow Chemical in Terneuzen. I've developed a lot of the models for production and supply chain planning based on fieldwork with Dow and have been able to test them there. One of the publications that I'm proudest of is the result of a detailed analysis of the planning processes at Dow.

Partnership with industry is embedded in our DNA, and that's more than just a slogan. As a university, we were set up with strong support from Philips. When I was studying, a lot of the professors came from Philips. Since then, that one-sided outlook has changed, but the links with industry have remained. We've really grown into *the* university of technology for industry.

## High-trust environment

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A characteristic that I've noticed over the years is the trust that people have in each other. I once joined a successful project in the Port of Rotterdam. In Rotterdam you first have to prove yourself before anyone will trust you. Here in the province of Brabant, people's basic attitude towards newcomers is one of trust until the opposite is found to be true.

Working together and sharing connections is something we also try to transfer to our students. For example, it's an essential part of the design-based learning approach that we follow. I also often hear from industry that our students are good

at teamwork. But on the other hand we sometimes have problems really integrating our Dutch and international students. That's still a challenge. What we're particularly good at is working together on highly-complex systems with people from different disciplines. It's no coincidence that ASML was founded in this region. Researchers often need to have a reductionist approach to get complexity under control. A model has to be as simple as possible if it is ultimately to lead to formal results. But here that's always based on the idea that we need to get back to reality. For many researchers, including those in our major research groups, the driving idea is: it's got to work! That reality-based approach is something that comes naturally, even to our mathematicians – and that's surely the most reductionist discipline of all!”

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*“Partnership with industry is embedded in our DNA, and that’s more than just a slogan”*

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## **Ir. Sagitta Peters**

Managing Director of the Institute for Complex Molecular Systems and the Intelligent Lighting Institute

**“It’s my job to make other people enthusiastic about what we’re doing here”**

**Sagitta Peters (1980) studied Chemical Engineering and Chemistry at TU/e, and became Managing Director of the Institute for Complex Molecular Systems (ICMS). Her first big challenge was to start that ambitious new institute. She also helped to shape the renovation of the Ceres building, the new ‘home’ of ICMS. She’s proud of all the interdisciplinary collaborations, of students who push their limits, and of the fact that Ceres has been named Building of the Year by the Royal Institute of Dutch Architects (BNA). Since 2013, she has also been Managing Director of the Intelligent Lighting Institute (ILI).**

“I always liked technology, but I certainly wasn’t only focused on science. I had no idea while I was in secondary school that there were jobs like the one I have now. When I thought of management jobs, I just imagined it was all about expensive cars and people in suits. In high school, I attended one of the open days held by TU/e, and I immediately found the atmosphere open and welcoming. I joined the study association, where I organized the first gala and helped to set up the management training days for students. I graduated from Bert Meijer’s group, and discovered that I was more of a ‘molecular’ type than someone who wanted to work as an engineer in industry. I did my internship in a company business intelligence department, and also got a certificate in Management Sciences. I didn’t really have a dream of doing research myself, and had the chance to continue working in the group as a trainee of policy affairs. There, I found out that I like working at the intersection of research, education and management.

### **Future dream**

Working on setting up the ICMS in 2008, helped to shape my future dreams and ambition. At first old study friends said ‘that’s not the right job for you, you should look for something in industry’. But I found it to be an interesting challenge. In my work, I strive for continuous improvement. The ICMS is ambitious and the result of collaborations on all fronts. The people who work here include chemists, biomedical engineers, engineers, physicists and mathematicians. We want to become one of the world’s top multidisciplinary institutes in this field.

## Driving change and innovation

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Research is all about knowledge and expertise, but also about innovation and pushing the limits. We need people who can drive change and lead innovation: enthusiastic people who aren't afraid to set new directions. People who do not just talk, but get things done. Because I am familiar with the world of science, I know what researchers need. Excellence is not just about the things we do, it is also about the kind of environment we do it in. The support and the environment must be of the same high quality. Our university strives for transparency and approachability. To promote collaboration, we installed glass walls in our building. This literally allows people to see what we are doing. It's my mission to make other people enthusiastic about what we're doing here. I draw my inspiration from the innovation enabled by scientific research and technology. And more recently from helping young people in their studies. I've started giving lectures on scientific skills. That's a great experience.

## Making choices

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Among the core values that define the DNA of TU/e, words that come to mind are down-to-earth, thorough and quality. Down-to-earth also means 'be yourself'. But I think it's even more important to be ambitious, and to pursue your dream, rather than just to stick to what's regarded as 'normal'. True excellence also demands a no-compromise attitude. We should emphasize that more as a university. We want to excel in many different areas. If we are willing to make choices a bit more often, we will be able to create a high-level plateau

with even higher peaks. We certainly have plenty of ambitious students here. A good example is the way our student teams from different departments work together on successful student projects. This has created a culture in these teams in which everyone works together with real drive and pride.

## Less conformity, more connections

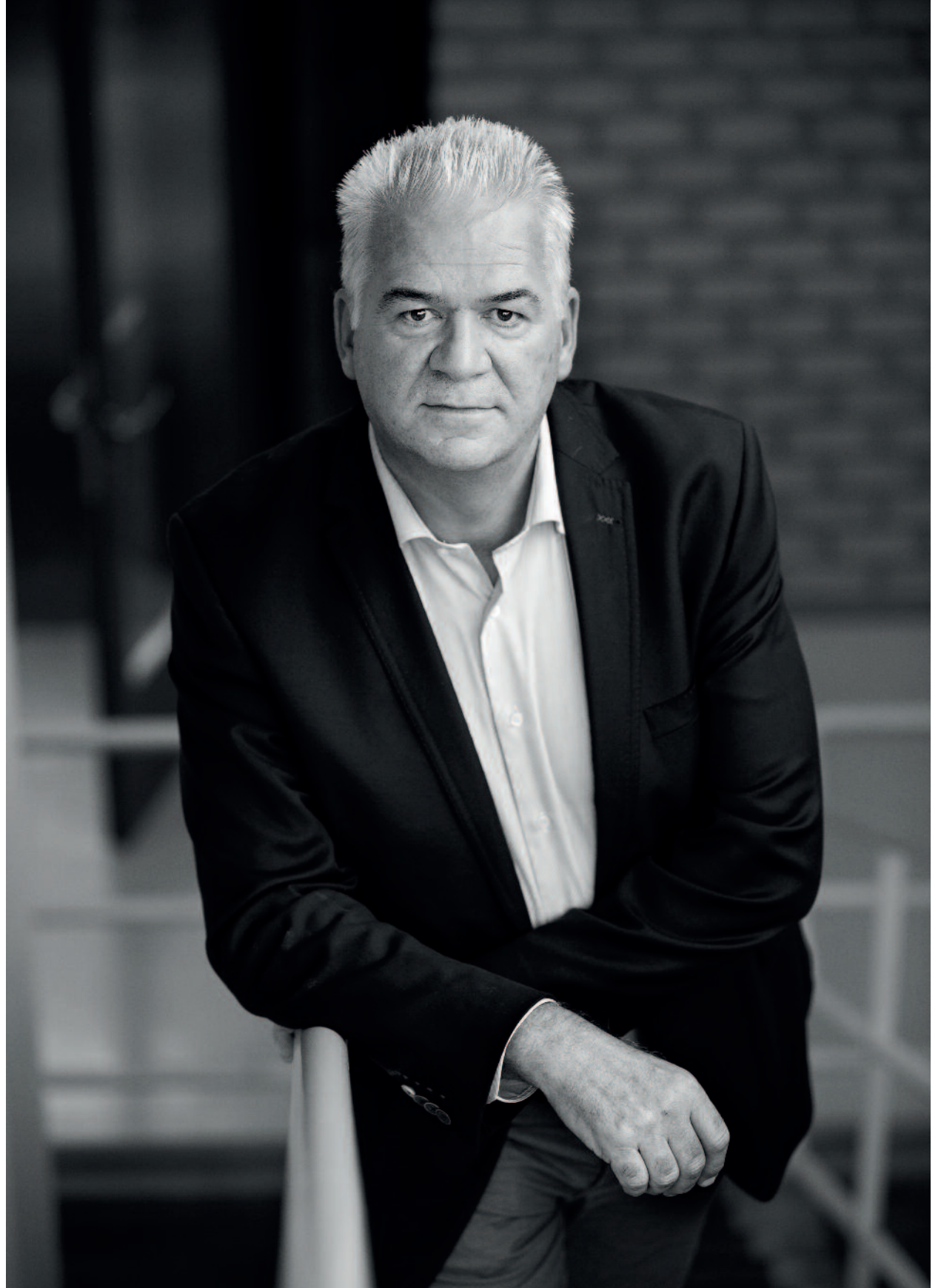
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There are a lot of people working here who strive to improve the world bit by bit through research. Maybe we are sometimes modest, which is in line with the down-to-earth attitude I already mentioned. We can still improve in terms of flexibility. We need less conformity and more cross-discipline connections, both inside TU/e and outside it. With the 'green campus', the Bachelor College and now the Graduate School, we are on the right track as a university. In my view, I am also in a very good position for my own personal development. There are so many opportunities. In just a few years, I have been able to take big steps forward in line with my own ambition."

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*“Among the core values that define the DNA of TU/e, words that come to mind are down-to-earth, thorough and quality”*

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**Prof.dr. Philip de Goey**

Dean of the Department Mechanical Engineering  
and Professor of Combustion Technology

# “Getting truly involved; that’s what drives me”

**Philip de Goey (1958) – professor, dean and recipient of the prestigious Simon Stevin Meester award – is a man of contradictions. He’s a pure theoretical physicist employed by a university that prides itself on its working relationship with industry. He’s a self-described world citizen who still happily lives in the small town where he was born. He’s also the dean of the Mechanical Engineering Department – a position that automatically imbues him with power and prestige – and yet this role also highlights his nurturing touch when dealing with others. “I find it very difficult to say ‘no’ to someone who asks for my help. I like getting involved with many people and projects and I’m always trying to improve the world around me. I think this is one of my greatest strengths as well as my biggest pitfall.”**

“As a child, I was already interested in physics. I wasn’t very drawn to experimentation but I found theory fascinating. At high school, I was often the best in the sciences and I knew that after graduation I wanted to pursue physics further at a university level. I wasn’t interested in coming to TU/e – it was too technical for my taste. So in 1977, I headed to the University of Nijmegen to study theoretical physics. After I received my degree, I immediately wanted to go on for a PhD but there was only one position available. I was really crushed when I didn’t get it. On the rebound, I decided it was time to strike a different path. I went to work as a teacher and I really enjoyed this period of my life. I loved teaching physics and I think I was good at it. However, my drive to engage in pure research never left me and I was happy when my former thesis professor tipped me off about a PhD position in Eindhoven. I found that my dislike for TU/e had disappeared during the intervening years and I jumped at the chance to begin this new phase of my life.

## **A symbiotic relationship**

Since 2000, I’ve been a full professor of Combustion Technology and the scientific director of the Combustion Technology Group since 2002. At the beginning of my career in mechanical engineering, combustion technology was an entirely new area of research for me and the way in which the mechanical engineers around me approached research was entirely different from how I worked. At first, I wasn’t sure I could survive at TU/e because of the research I was interested in doing. But after a while, I understood that there are also a lot of theoretical challenges in combustion science and there are also lots of possibilities to contribute to knowledge. The specific topic is not necessarily important. Because I study combustion – specifically, idealized flames – and this topic is related to applications, I saw that

I have a place here. And in turn, I've developed a symbiotic relationship with the university. Over the years, I've begun to move from pure theory to the applicability of my research. For example, the models we develop, based purely on theory, are used in the heart of the software codes Rolls Royce uses to develop gas turbines.

## Duty calls

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When I was asked to come on as dean, I was at the height of my own research. It was an incredibly busy time for me and taking on this appointment – while a great honor, of course – couldn't have come at a more hectic time for me. But duty called and I accepted the position anyway. I was not sure that I'd enjoy the work but, over time, I've come to love it. I don't see myself as the boss but rather as the person to instigate discussions and to nurture everyone's skills and talents. I simply try to help everyone as best as I can. And this philosophy has paid off. People in this department now feel that things are running smoothly and that we're all working together as a well-organized team.

## Making a contribution

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I'm very happy to be at TU/e. We're a small-scale place and social contacts here are very good. Our openness to communicate with each other – we even have bridges linking our buildings to each other – is one of our greatest strengths. I think at other technical universities, there's more inter-departmental fighting than at TU/e. Of course, I'm proud when the Mechanical Engineering Department does well. But I like it even more when

the university as a whole does well. What drives me? I would say 'getting involved' by tackling both small and large-scale projects. As a theoretical physicist, I'm fascinated by exploring the mechanics of how the world works. I love to dig deep and I enjoy looking at the smallest details of how things function and trying to solve little pieces of the puzzle. I get a real kick out of that – simply from the exploration itself but also from the idea that my research could have a significant impact on the world. But I'm also passionate about helping people and my community. Simply being involved with everything around me, truly involved, is what drives me in both my work and my personal life.”

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*“Our openness to  
communicate with  
each other is one of  
our greatest strenghts”*

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## Smart Jacket for premature babies

Together with the Máxima Medical Center (MMC), TU/e has developed a prototype wireless 'baby jacket' with sensors. The jacket is intended for premature babies in intensive care units. The 'Smart Jacket' eliminates the discomfort of sensors stuck to the skin, and makes it easy for parents to hold their baby outside the incubator. TU/e and the MMC are combining their knowledge, expertise and innovative strength in the development of new methods for diagnosis and treatment.





## Safe pregnancy monitoring

PUREtrace is a novel system to record uterine activity based on electrophysiological signals that are generated by the body during contraction of the uterine muscle. The technology is used during pregnancy and labor to assist in the assessment of fetal well-being using cardiotocography. It provides more information to clinicians, is easy to use, and comfortable to wear for pregnant women.

PUREtrace is the result of research between TU/e and Máxima Medical Center and is marketed by spin-off Nemo Healthcare.



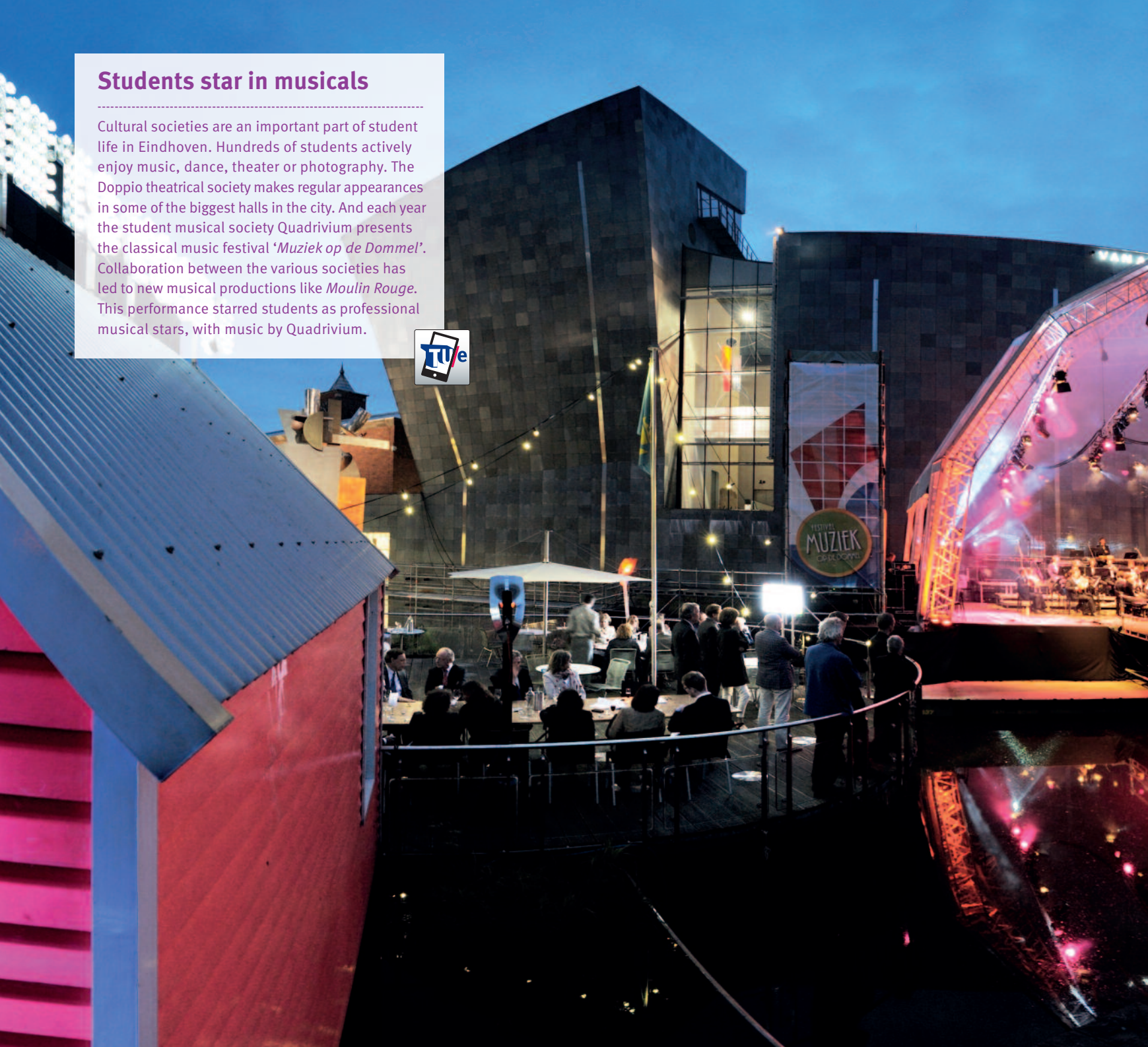


## **'Brain wiring' images help surgeons**

In brain surgery it's useful to know the exact location of the 'brain wiring' in advance of operations to avoid damage. Researchers at TU/e have developed a useful program that gives surgeons a three-dimensional image of the main connections in patients' brains using MRI scans. The strengths of TU/e include medical imaging technologies of all kinds; allowing surgeons to make better diagnoses and to improve the planning of operations.

## Students star in musicals

Cultural societies are an important part of student life in Eindhoven. Hundreds of students actively enjoy music, dance, theater or photography. The Doppio theatrical society makes regular appearances in some of the biggest halls in the city. And each year the student musical society Quadrivium presents the classical music festival 'Muziek op de Dommel'. Collaboration between the various societies has led to new musical productions like *Moulin Rouge*. This performance starred students as professional musical stars, with music by Quadrivium.





## Art connects...

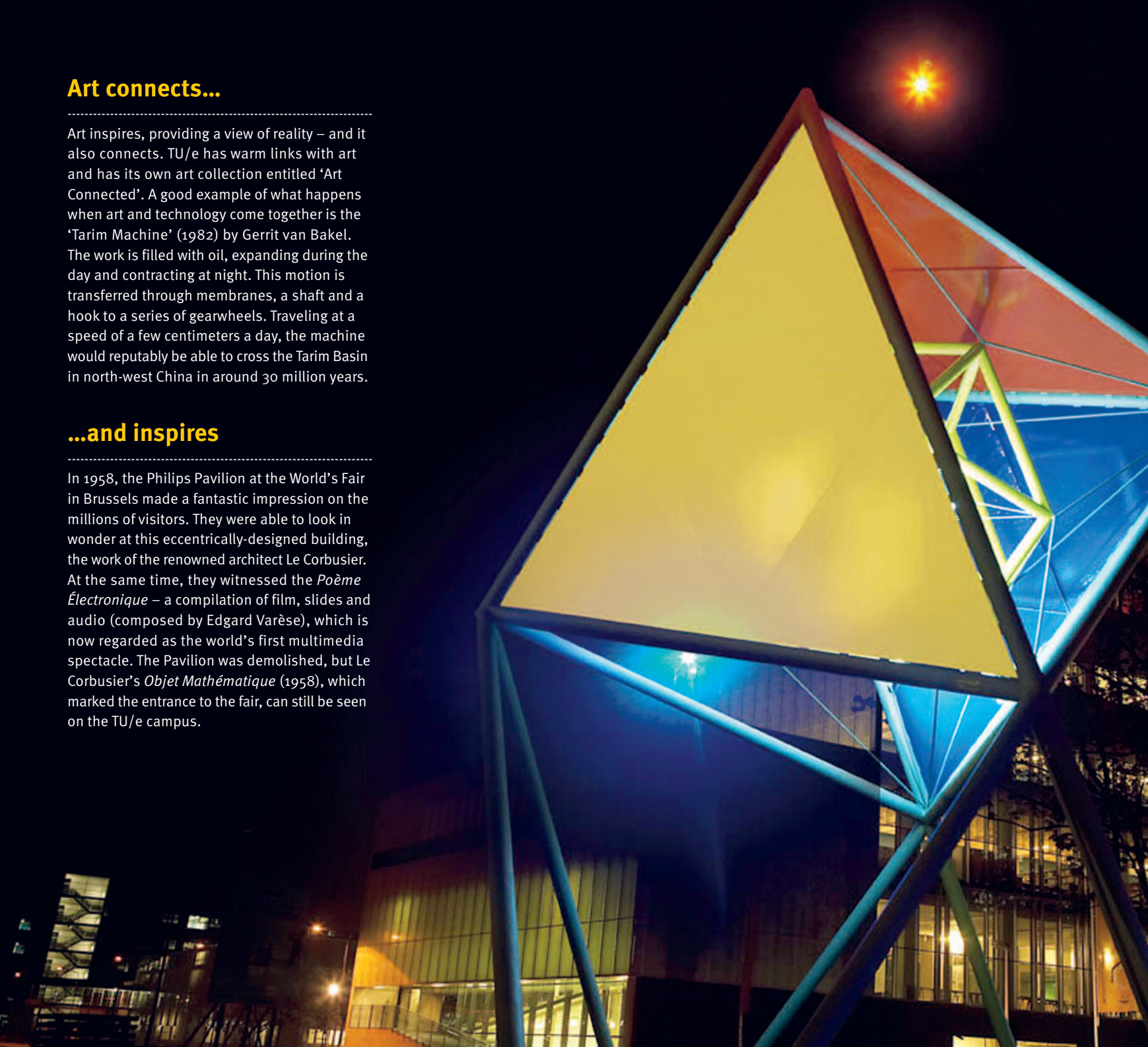
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Art inspires, providing a view of reality – and it also connects. TU/e has warm links with art and has its own art collection entitled ‘Art Connected’. A good example of what happens when art and technology come together is the ‘Tarim Machine’ (1982) by Gerrit van Bakel. The work is filled with oil, expanding during the day and contracting at night. This motion is transferred through membranes, a shaft and a hook to a series of gearwheels. Traveling at a speed of a few centimeters a day, the machine would reputedly be able to cross the Tarim Basin in north-west China in around 30 million years.

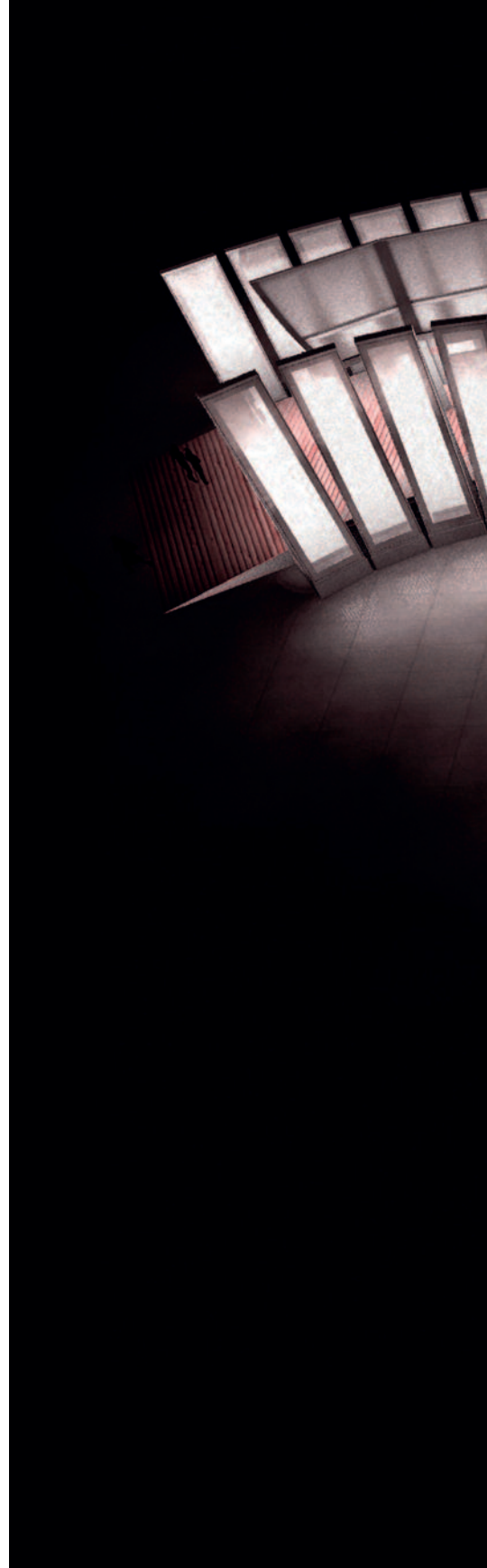
## ...and inspires

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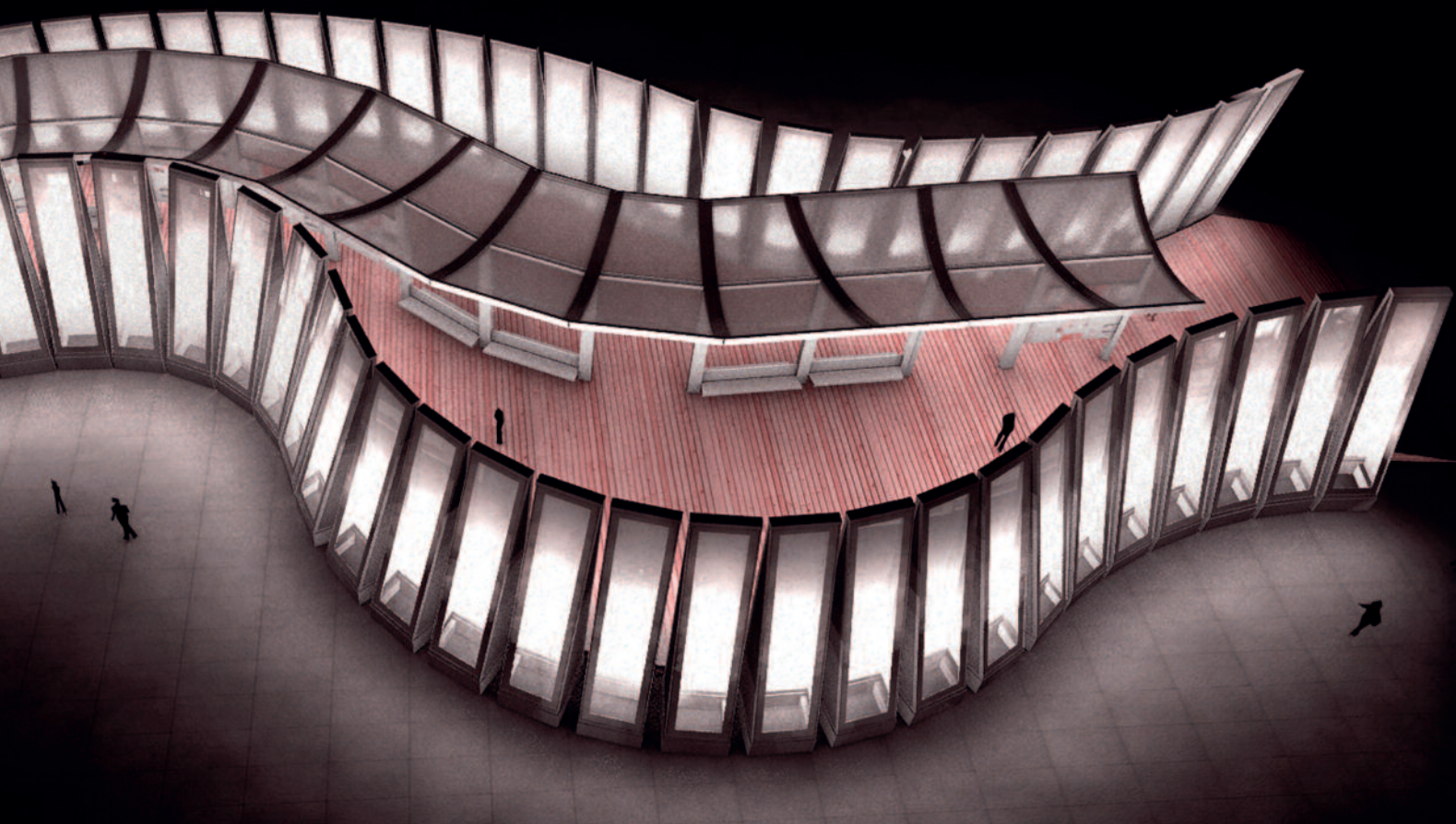
In 1958, the Philips Pavilion at the World’s Fair in Brussels made a fantastic impression on the millions of visitors. They were able to look in wonder at this eccentrically-designed building, the work of the renowned architect Le Corbusier. At the same time, they witnessed the *Poème Électronique* – a compilation of film, slides and audio (composed by Edgard Varèse), which is now regarded as the world’s first multimedia spectacle. The Pavilion was demolished, but Le Corbusier’s *Objet Mathématique* (1958), which marked the entrance to the fair, can still be seen on the TU/e campus.











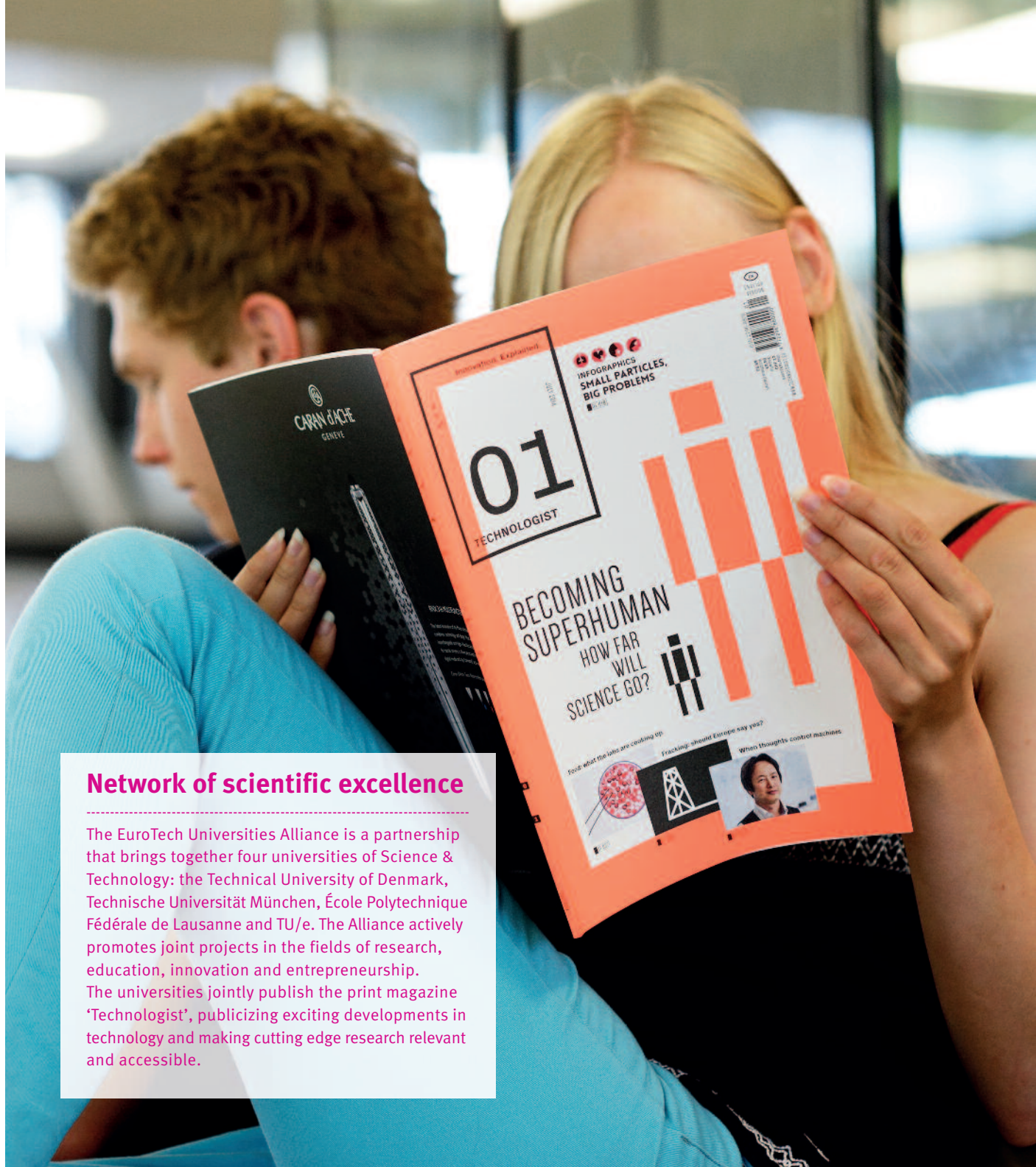
## Dutch Design Week

Eindhoven has earned a place on the world map as an international city of design. Each year the Dutch Design Week (DDW) draws thousands of visitors from the Netherlands and countries around the world. The DDW gives TU/e a great opportunity to show off our students' work. Industrial Design students present, for example, their own projects using interactive prototypes. The design of the Brainport Pavilion – a project by Built Environment students – was on show during the DDW and provides a flexible, mobile exhibition space for technology innovations.

## Sustainable overnight stays in Hiker's Cabin

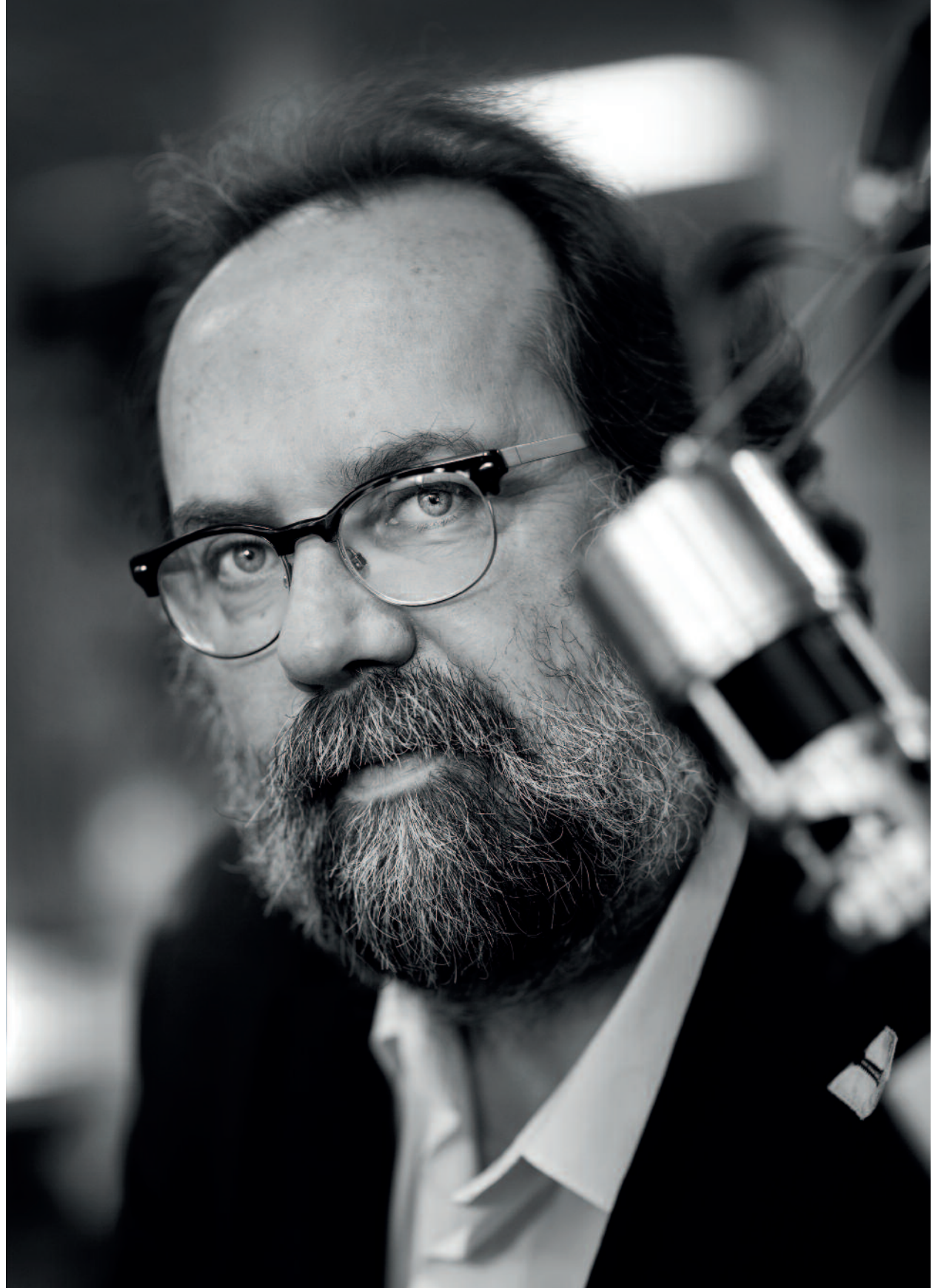
The 'Trek-in' Hiker's Cabin is based on a design prize submission to TU/e by the *Bouwkundewinkel* (Built Environment Store). A multidisciplinary team of six students designed the wooden cabin that fits in different natural landscapes and has a homely, warm look. Walkers can make overnight stays in the cabin. Sustainability was an important requirement in the design and building process, and almost all the wood from which the Trek-in cabin is made is re-used.





## Network of scientific excellence

The EuroTech Universities Alliance is a partnership that brings together four universities of Science & Technology: the Technical University of Denmark, Technische Universität München, École Polytechnique Fédérale de Lausanne and TU/e. The Alliance actively promotes joint projects in the fields of research, education, innovation and entrepreneurship. The universities jointly publish the print magazine 'Technologist', publicizing exciting developments in technology and making cutting edge research relevant and accessible.



**Prof.dr.ir. Maarten Steinbuch**  
Professor of Control Systems and  
Distinguished University Professor

# “The car of the future is an iPad on wheels”

**As the son and great-grandson of mechanical engineers, Maarten Steinbuch ( 1960) was born with a fascination for technology. “I find the combination of theory and experimentation highly relevant. That’s why we don’t just have academic setups in our lab – you’ll also find practical equipment. It’s a challenge for students to try out the latest methods on those systems.” Steinbuch has been professor of Control Systems since 1999, and that was followed by his appointment as Distinguished University Professor in 2013. In recent years, he’s been working on raising awareness for technology in the media.**

“My mother was a mathematics teacher. As a child I played with Meccano with my father. I liked converting worn-out prams into carts, and I had the freedom to experiment. That was a formative experience. When I started studying, I didn’t know if I wanted to do Mathematics, Electrical Engineering or Mechanical Engineering. I finally chose Mechanical Engineering because the department had equipment that moved. That brought technology to life.

## Combining disciplines

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During my third year, I discovered how exciting systems and control technology could be. It’s all about mathematical descriptions of the dynamic behavior of systems. Whether it’s about machines, cars or chemical processes, the ‘common language’ is system’s theory, an area that combines mathematics, electrical engineering and mechanical engineering. I obtained my PhD in control of wind turbines, because of the interesting combination of technology and societal relevance. After that, I got a job in the Philips ‘NatLab’ research labs, where I worked in a lab alongside the physicists. There I learned what it means to do focused research in a family culture, and I also came into contact with other disciplines. The constant drive to broaden my scope has always played an important part in my career. After an exciting period of twelve years at Philips, I started at TU/e. My drive was to do research into the control and design of motion systems, such as medical robots. That step to TU/e worked out well: I have the freedom to determine my own research, to pursue my own ambitions and to work with young people.

## Connecting through content

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My group has now become mature, and I've put a lot of energy into external contacts in the Brainport region. The automotive industry in the region wants to grow. That's led to the drive to innovate and strengthen education, with the aim of educating more engineers. I see the car of the future as an iPad on wheels. We've set up the Automotive Master's program following a multidisciplinary approach, and we're creating connections based on content. The Master's is hosted by the Department Mechanical Engineering, but a total of six departments are involved. We've introduced systems-based thinking into the program. We also now have a bachelor program as well as a post-master's program in automotive. People are aware that they're contributing to a valuable development. There's a real sense of community. Every other month, we organize an 'Automotive lunch' for around 25 people. Everyone is aware that we have a unique position in the Netherlands.

## Historic connections

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TU/e's most important added value is that we're continuing to build on connections that have been there for a long time. We provide well-educated people with specialized knowledge that matches the needs of the region. Industrial research has become less fundamental over the years. That makes the role of the university even more relevant. We have to ensure that in the long term there are enough young people to work on the innovation we need. TU/e is worldwide right at the top of the list in terms of joint publications with industry. That's a direct result of the historic connections with Philips and her spin offs. The importance of that influence is invaluable.

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*“We have to ensure that in the long term there are enough young people to work on the innovations we need”*

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## Creating connections

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Things are really changing at TU/e, and we've been able to recruit increasing numbers of students. There's an awareness that we need to grow; that we have to be the best, and we also have to communicate that externally. We combine the friendly tradition of the Brabant region with a hard-working, 'standing strong together' approach. That's very inspiring. The Triple Helix in which industry, government and knowledge institutes work together is effective in practice because creating connections comes naturally to us here in the region. TU/e proves that theory and practice go hand-in-hand. Let's recognize that we have the best of both worlds here. Working on fundamental and applied research in an informal educational culture in which we can reach an outstanding performance together.”

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*“TU/e is worldwide right  
at the top of the list in terms  
of joint publications with  
industry”*

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**Prof.dr. Federico Toschi**  
Professor of Computational Physics of  
Multi-scale Transport Phenomena

# “I really enjoy the process of science”

**Since 2008 Federico Toschi (1971) has held the chair of Computational Physics of Multi-scale Transport Phenomena in the Department of Applied Physics and the Department of Mathematics and Computer Science. His research interests include statistical fluid dynamics and high-performance computing. He gained a PhD from the University of Pisa, the city where he also studied at the Scuola Normale Superiore, and the same institute at which Nobel Prize Laureate Enrico Fermi studied physics. Since his school days, Toschi has combined his passions for physics and mathematics. When he was only in fourth grade, he was selected for the Italian team in the International Physics Olympiad.**

“My first job in the Netherlands was in Twente. I was looking for a postdoc position and they were setting up a new group. I was anxious to take part in the birth of something new. I found a place to live in Enschede. I always thought of the Netherlands as a quiet place. I was alone at home reading a book on Saturday 13 May 2000, when all of a sudden a big fireworks disaster struck the town. My house was in the same street and was badly hit. I had to run as fast as I could. My personal belongings were totally destroyed but, fortunately, I wasn't injured. But the experience didn't stop me from coming back to the Netherlands!

## **New things, new people**

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After my postdoc I went back to Italy and worked in Rome for the National Research Council. I wasn't actively looking for a new position, but I was told there was this opportunity in Eindhoven which sounded attractive. What really made me decide to come was the change of environment, the possibility to learn new things and to work with new people. This is how you can grow as a scientist. I had been working with very good colleagues in Rome, and I still am, but I couldn't really start experimental work there. It was very attractive to come to Eindhoven because there was already a laboratory with the necessary expertise. Of course, there are differences here compared with working at an Italian university. The groups here are bigger, and an important role is assigned to the research work done by PhD candidates. In Italy, students who want to apply for a PhD position have to pass an examination, earn a fellowship and then decide who they want to work with. In the Netherlands, a research group looks for talent to work on a well-defined project.

## Trust and openness

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People at TU/e are really open when it comes to collaboration. I like that a lot. You feel you're always welcome to discuss a scientific topic with a colleague. They make time, even if everybody is very busy. I also like the close cooperation with local industry, resulting in joint publications. That is stimulating. I think it's also very important to work for society. Open and friendly, that's how I would describe the atmosphere. Trust and openness are important factors here. To advance science today, we really need a collaborative and open approach and we need to bring together the capabilities of various disciplines.

## Scientific challenges

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The problems we face are complex, tough and mostly interdisciplinary. It isn't easy to describe what I would like to achieve in the long term, because research is difficult to predict. I work on different things, mainly focusing on processes in fluids which have more or less unpredictable behavior: for instance turbulence or chaotic motion. Fluid flows are everywhere: the air and oceans are common examples. I have been working with industries on problems related to fluids and gases. But we are also working to improve cooling systems. Blood is also a very complex fluid that we're interested in. But we would also like to understand how plankton grow in the ocean. Plankton play an important role in the food chain, and phytoplankton are responsible for about fifty percent of photosynthesis. The biological process is completely influenced by the way these plankton populations are transported in the ocean. The

worlds of biology and chemistry seem to be getting closer with the increasing awareness of the need for a better understanding of flow transport. Mathematical models, physics and engineering can support this progress. I really enjoy the process of science; when you struggle to understand a problem and discuss it with colleagues. You have to go step-by-step. It's difficult for me to distinguish between fundamental and applied research. Sometimes applied questions are actually very deep. And questions from industry or other disciplines can help us to better understand the mathematics and the physics of fluids. Looking at the changing world and the implications for engineering education, there are many challenges. We need people who will be able to move in a multicultural and multidisciplinary context.”

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*“To advance science today,  
we really need a collaborative  
and open approach and  
bring together competences  
from various disciplines”*

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**Dr. Miranda Nabben**  
Postdoc Biomedical NMR

**“In the end it  
is all about the  
application”**

**Miranda Nabben (1980) studied Clinical Chemistry, and Biomedical Laboratory Sciences after finishing high school. She continued with a Master’s in the field of drug innovation and earned her PhD in Human Biology. Following research projects in Utrecht, Cape Town, Maastricht and Seattle, she joined the Nuclear Magnetic Resonance group as a postdoc at TU/e. Together with Philips Research, this group’s researchers share a building on the High Tech Campus Eindhoven.**

“I was always attracted by the biomedical field. When I was little, I wanted to become a doctor and work in a hospital. During my internship in the hospital laboratory, I had the chance to analyze patients’ blood samples. However, I wanted to do more than just put test tubes in a machine and wait for the results. I wanted to do research myself. Later on, I was granted a 10-month internship at the Stellenbosch University in South Africa. It was great to meet so many people from different cultures! But I was particularly fascinated by the obesity and heart failure research. After finishing my bachelor’s, I wanted to continue with this topic. Eventually, I finished my PhD studies on the role of a particular skeletal muscle protein in obesity, diabetes and ageing. Interestingly, the protein seemed more important in cardiac muscle compared to skeletal muscle, and that is how my scientific interest in the heart got started.

### **Helping patients**

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Currently, I study the role of fat and sugar metabolism in the body. At TU/e, my research focuses on protection of the heart against the development of heart failure and diabetes. Worldwide, there is a strong relationship between these two diseases. I want to know the changes that occur in the heart when it turns from healthy to failing. Obviously, my curiosity plays a role – I want to know what is going on – but in the end the most important thing is the clinical application, being able to help patients improve their lives.

### **Personal grant**

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My first big step at TU/e was to be awarded a NWO VENI- grant, a prestigious Dutch grant for researchers who have recently obtained their PhD. Many people supported me with this application. To make sure it would go smoothly, I practiced the

interview in front of colleagues, friends and family. When I received the news that I had been granted € 250,000 I could not believe it at first. But then a feeling of pride took over, especially since it is a personal grant. I'm not someone to boast about my own achievements, and I used to look up to people with a VENI grant, but now I received one myself. Pride can sometimes be useful, but I feel that modesty is a better characteristic for a researcher. The atmosphere in research groups can be very competitive, which often does not benefit teamwork. What I prefer at TU/e is people that show they have confidence in you.

## Diverse family

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Here at the High Tech Campus Eindhoven we work in a group of 25 people in a facility that we share with Philips Research. Our group mainly consists of young people with different areas of expertise, like physics, computer sciences, chemistry and biomedical engineering. Also, in terms of nationality, we are very diverse, with researchers from Indonesia, Portugal, Egypt, Italy, Germany, Belgium, China and Malaysia. English is, therefore, the working language. We are a close-knit team, almost like a family.

Teamwork is strongly encouraged within our group. Our professor is very approachable, very open and interested in how things are going. I have a lot of freedom, and people are always ready to listen when I come up with new ideas. I can see that

everyone has the ambition to do their best work and that there is lots of trust in each other's ideas. My colleagues with a technical background mainly have the ambition of developing new techniques. I particularly like the combination of people with different expertise. I do not have a technical background, but I like to use these latest developments so my work can ultimately help patients.

## Motivated students

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What impresses me most about TU/e's students is their motivation and commitment. To me, this is very rewarding. I'm not sure what I will be doing in ten years from now, but at this moment I would like to see myself carry on with my research in academia. TU/e collaborates with many industrial partners, hospitals, and universities around the world. The results of these collaborations are often top-level. What I would like to see is technology and life sciences getting closer together. This will lead to the best results for what is ultimately one of the most important scientific challenges: to help humanity.”

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*“What I would like to see is technology and life sciences getting closer together”*

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## Ceres: boiler house gets a new use

The TU/e campus is undergoing a transformation in which as many existing buildings as possible are being re-used. One striking example is the former boiler house, the Ceres building. Its original function of supplying hot water for the heating system is now obsolete. The boiler house was rebuilt to provide attractive accommodation for users including the Institute for Complex Molecular Systems. And successfully – Ceres was named Building of the Year by the Royal Institute of Dutch Architects (BNA) in 2013.

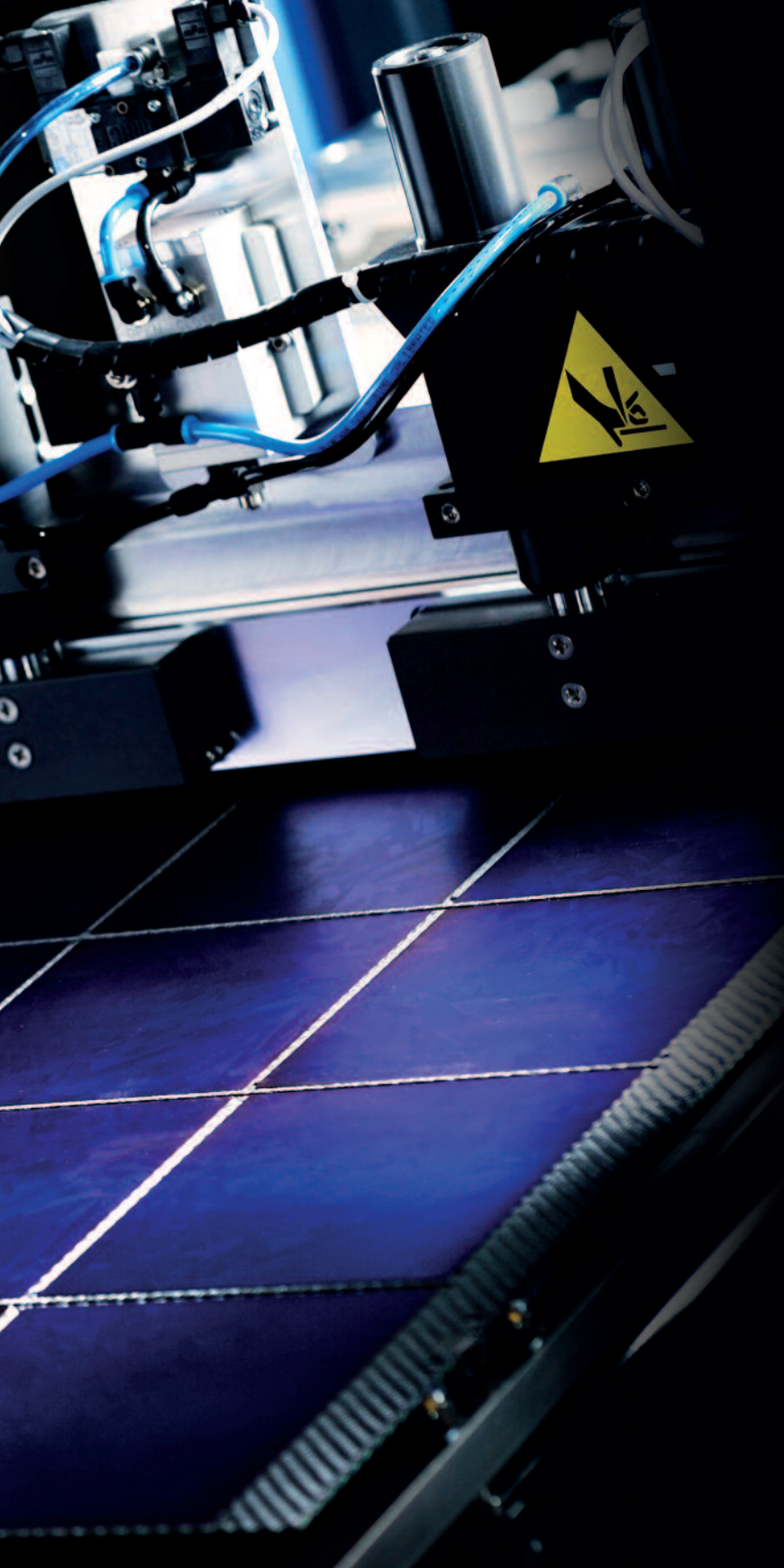




## Intelligent lighting on the TU/e campus

Rapid developments are taking place in the world of light and lighting design. The Intelligent Lighting Institute at TU/e tests its lighting systems on the TU/e campus. The street lighting uses the latest generation of LEDs, which means it is energy-efficient and can be controlled at the level of individual lighting masts. This is one of the ways in which scientists are researching how people experience light. Lighting innovations can also be found outside the campus. For example, TU/e is working with Philips and the municipality of Eindhoven on making the Stratumseind – the leading nightlife area in the South of the Netherlands – both safer and more attractive.





## Solar energy for everyone

Plastic solar cells are expected to make solar energy accessible for everyone. They are much cheaper, made of abundantly-available materials, and they are light and flexible. Scientists at TU/e are working on the physical and chemical technology of plastic solar cells to overcome what is currently the biggest obstacle: increasing the energy output to bring down the price per kWh of electricity produced.



## Olympic ambitions

Excelling at sports is important at TU/e. The university isn't just a great place to study – it also offers top sports performers the chance to make their dreams come true. Together with the Eindhoven Student Rowing Club Thêta, TU/e is investing in rowing at top level. Thanks to the expertise at TU/e, rowing has benefited from a lot of technological improvements. The ambition is that Eindhoven students will excel at the 2016 Olympic Games in Rio de Janeiro, and in the following Olympics in 2020.



## Photonic revolution

This is a test set-up for a nano-photonics chip made in the TU/e nanolab, one of the world's best equipped university cleanrooms of its kind. Photonics is vital for the future of the internet. Worldwide data traffic is growing explosively, and with it the required energy, especially for data centers. This means data transport has to rely on photonics as much as possible, because the light signals used in the photonics process use far less energy than regular electric signals. TU/e is a photonics hotspot, with its breakthrough research in materials, components and systems.





## Thank You!

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Successful communication starts with knowing where you stand. How are you regarded and experienced as an organization? And how do you see yourself? Useful and effective communication needs a clear point of departure. That's why we've decided to clearly present what we stand for. Our quest for the 'DNA' of TU/e was an intensive and very interesting process. Of course, as the Steering Committee we already had a view of our values, our distinguishing characteristics and TU/e's *raison d'être*. But do they match the perceptions of our employees, students and alumni? A series of in-depth interviews and discussion sessions gave us the answers. You'll find the results of our search in this book. It's a story that connects our DNA with the future of TU/e. A story we can be proud of!

On behalf of the TU/e DNA Steering Committee, I'd like to thank the many colleagues and students who have made a valuable contribution to that process. I'm glad you were all willing to take part so enthusiastically in our discussions. Now that our story has been written, it's time to share it and bring it to life. And to show, through numerous excellent projects, just what we can all achieve together!

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**Drs. Sabine van Gent**

Director of the Communications Expertise Center







*hora est*



## Colophon

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### Steering Committee TU/e DNA

Jo van Ham (*Vice President of the Executive Board*)

Anthonie Meijers (*Distinguished University Professor*)

Sabine van Gent (*Director Communications Expertise Center*)

### Project Management TU/e DNA

Ester Bolkestein

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Bart Scheepers, Artūrs Martinovs, TU/e research group

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