issue #8

UNIVERSITY OF TWENTE.

# U-TODAY

Science & Technology Magazine

## A MINUTE TO midnight

DISASTERS: COMING SOON

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# Independent and *outspoken!*

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# Disaster journalism

On the 11th of September, 2001, I was a recently graduated journalist working at the Twentsche Courant Tubantia in Almelo. On a small TV, I saw a live footage of the second plane flying into a tower of the World Trade Center. What happened next was a very interesting learning process for me. As a person you are completely upside down and full of emotions, but as a journalist you have to act and switch at lightning speed.

On the 20th of November, 2002, it was just half a year since I started at the University of Twente as an UT Nieuws editor. When I arrived to the campus at about eight in the morning, it was immediately clear that a disaster was unfolding. The former TW / RC building, the current Cubicus, was in flames. What started with a small fire led to an accumulation of disastrous events. The UT network fell flat. The working rooms burned out completely. Complete archives, papers and theses went up in flames. Employees and students were walking around in despair.

The former UT Nieuws made a paper emergency edition. We tried to get as much clarity as possible about the cause, damage and consequences of the fire. As a journalist you have only one task in such a situation: telling the true story. It was the time before social media and smartphones. People were eager for information. The emergency edition was in great demand.

These days it is no longer so difficult to get the news out quickly. Much more important is the role of quality journalism. Stories quickly start a life of their own via social media. But who checks the facts? Who explains the news? Unfortunately, journalists soon get the stamp of press mosquitos, especially in disaster or war reporting.

I argue for the indispensable objective role of journalism in catastrophes. What is indisputable is that reporters must perform their work with respect and with consideration for people's privacy. Give them the space to do their work, because citizens have the right to objective, reliable information and to form their own opinion. Someone has to keep a cool head, a role that fits us.

Marike Platvoet

**Editor-in-chief at U-Today**

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## *Colophon*


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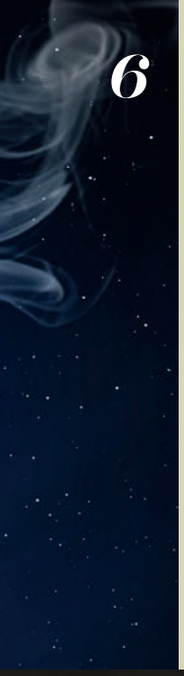




# U-TODAY

## Science & Technology Magazine

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Text: **Michaela Nesvarova & Rense Kuipers**
Photos: **Shutterstock**

# A minute to midnight

**Scorching heat drying out our lakes and ponds. Heavy storms flooding our streets, gardens and houses. The changing climate is coming closer and closer to home. It is no longer 'only' about melting ice caps thousands of kilometers away. And the disasters that climate change is fueling are beginning to hit us all. What can we do to prevent these (un)natural disasters? UT researchers share their views on risks, resilience and possible solutions.**

'Five, four, three, two, one, we have lift off...!' The crowd cheers as the rocket thunders towards the sky. With less than a minute to midnight on the 'global disaster clock', the rocket and its contents are meant to save us all. It will release sulfate aerosols into the stratosphere, blocking the sunlight. If this fails, there is always the option of deflecting sunlight away from Earth using space-based mirrors or other technologies to artificially cool the planet.

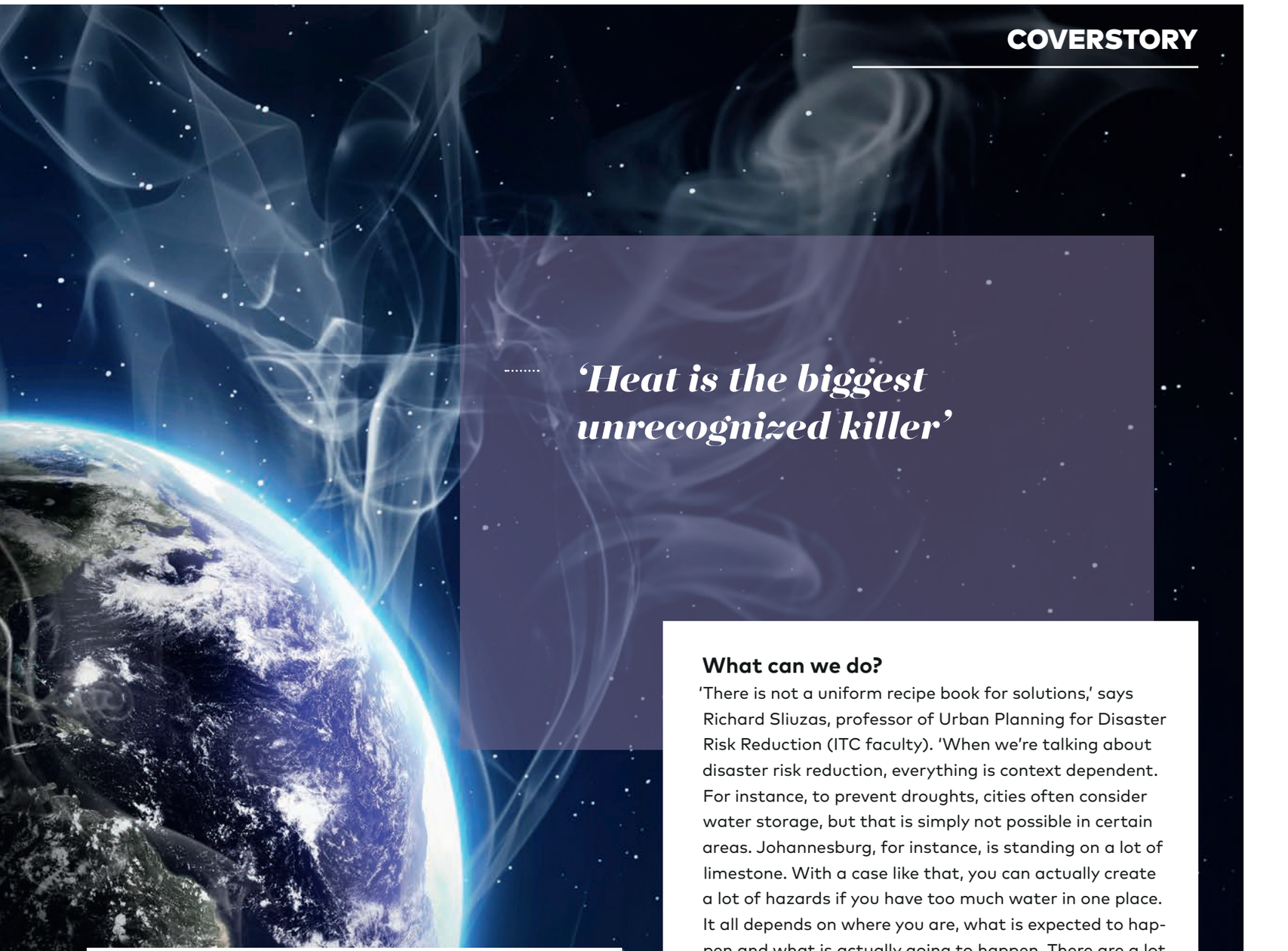
Sounds like a solid plan, right? 'It is not a sustainable solution but if we are near the edge of the runaway climate effect, it could be a desperate last-minute resort. But that is just what it is: a desperate solution,' warns Maarten van Aalst, professor of Spatial Resilience for Disasters Risk Reduction at the ITC faculty. Is there another way? Is there a better way to protect ourselves against the risks that we are creating and consequently facing?

Climate change is happening. And disasters are happening. But: Are natural disasters fueled by climate change and are they becoming more common and severe? And do they have the power to end us all? 'Climate change certainly adds to the level of risk,' says Van Aalst. 'Weather is getting more volatile and more extreme. It is becoming harder to predict, and so are climate related disasters: heat, draughts, storms and consequent flooding.'

## Hazard ≠ disaster

While we can hopefully stop or limit climate change, it's hard to imagine how we could prevent or limit natural disasters. 'The expression "natural" disasters is becoming disliked,' says Van Aalst. 'We only talk of a disaster if it occurs in a place of significance, such as cities. If it happens at a place where nobody lives, we don't consider it a disaster. It is therefore a matter of exposure and vulnerability. Yet, if you say "natural disaster" it is interpreted as an act of God, as an outside thing that we can't influence. But it is our vulnerability and exposure that determine the disaster. In other words, no disaster is natural. Sometimes the word "natural" is used as an excuse for things that we are not managing well. There are always risks, but we are actively constructing some risks, especially by the way we build cities and treat landscapes. Disasters will always happen, but we could prevent economic damages and casualties.'

Tatiana Filatova, Professor in Computational Resilience Economics (BMS faculty), agrees: 'There are natural hazards, but they become disasters when assets are damaged at large scale and human lives are impacted. A disaster is the socioeconomic part of a hazard event. For centuries societies have been adapting to live with hazards, for example by building dikes against floods or irrigation systems to maintain agriculture through dry periods. At the same time, climate change adds to the probability of hazardous events, especially floods, and most of the world population lives in cities, which are – for usually historic reasons – built near waterways and therefore are prone to adverse events. With accelerating urbanization in flood-prone area we are preparing the perfect recipe for disasters. Because not only is the probability of disasters increasing, there is more at stake if a disaster hits.'



## *'Heat is the biggest unrecognized killer'*

Storms and floods are the most widespread disasters, which also affect the most people and often bring the largest economic damage. In terms of deaths, however, 'heat is the biggest unrecognized killer', points out Van Aalst. 'There are naturally limits to what we can physically cope with, but largely we can also adapt. We need heatwave plans – which we didn't have until rather recently. In the 2003 heatwave we had 65.000 excess deaths across Europe, 1000 of them in the Netherlands. In 2006 we had 1000 excess deaths in the Netherlands. After that we got a heatwave plan. If it were floods or airplane crashes that killed those people, there would be a huge public outcry, but this is less visible. It is still a lot of deaths and – in principle – preventable deaths.'

### What can we do?

'There is not a uniform recipe book for solutions,' says Richard Sliuzas, professor of Urban Planning for Disaster Risk Reduction (ITC faculty). 'When we're talking about disaster risk reduction, everything is context dependent. For instance, to prevent droughts, cities often consider water storage, but that is simply not possible in certain areas. Johannesburg, for instance, is standing on a lot of limestone. With a case like that, you can actually create a lot of hazards if you have too much water in one place. It all depends on where you are, what is expected to happen and what is actually going to happen. There are a lot of factors in play: poverty, preparedness and location. If you compare the hurricanes of India and Mozambique, the cyclones were comparable but the number of deaths in Mozambique was far greater. Years ago, about 10.000 people died in India because of a cyclone. Then they installed warning systems and created emergency shelters. The number of deaths caused by cyclones decreased tremendously.'

Maarten van Aalst also mentions recent cyclones in Mozambique as an example of 'preventable suffering'. 'There were two cyclones in one season – this has never happened before and it brought on immense suffering, but it was preventable to some extent. So the question is: are we working on the right solutions? People tend to focus on quick and visible solutions, such as sea walls, but that is not necessarily a solution to protect the most vulnerable. We need to work with the local communities, engage them in the issue. But this approach is much more complicated and less visible.'

## Locals to the rescue

His ITC colleague Professor Sliuzas agrees, stressing the importance of community engagement. 'I think we need community-based planning which is inclusive and doesn't ignore the poor. Because the general rule of thumb with climate related issues is that the poorest are the most vulnerable,' says Sliuzas. 'Very often a community can do a lot for itself, people are more than willing to help improve their direct environment.' People also seem to be more trusting of information coming from their direct environment, from within their community. Although, in many areas, there are early warning systems in place, locals don't always listen to them. 'Which is why we work with communities,' repeats Van Aalst. 'Just one example from Ghana: local fishermen received an early warning from the government to not go on the water. But they also needed to catch fish to feed their families and just didn't trust the warning. We had a volunteer in that community and warned him about the danger. He decided to stay on shore himself and nobody else went either. There was a big flood but nobody died that year thanks to this. Science and scientists play a critical role in better understanding why and where risks appear, but it is not just the information that determines the decisions.'

*'We need to make people aware'*

'A lot can be gained by asking the question where the most probability of hazardous events is,' adds Sliuzas. 'Furthermore, there needs to be a discussion about what is an acceptable level of risk now and in the future. And we need to make people aware. For which information is key. Sharing information is key. Part of that is negotiating and understanding what motivates people to live somewhere.'

## Fear rules us all

Understanding why people live in hazardous areas, how and when individuals perceive risks and are

prepared to act on them – that is the knowledge Tatiana Filatova is after. With her research group, she designs spatial simulation models with artificial societies to study socioeconomic impacts of disasters and climate change. What is the main trigger that makes people act in face of risks? 'If it comes to risk perception, we've observed that people don't process probabilities very well,' answers the professor. 'We don't understand the risks in remote future. Our perceptions are very biased and subjective. People don't treat gains the same as losses, they unrealistically overestimate losses. People are ruled by fear that cannot be rationally explained.'

'We have conducted two surveys. One among farmers in the Netherlands and one among households in the US,' continues Filatova. 'What we found is that in both cases it is deep psychological factors that trigger you to make decisions in face of risks. Even farmers, who are basically running a business and should be making rational business-oriented decisions, are more prone to make decisions based on subjective factors such as fear. Fear seems to be the strongest motivator.'

This fear guides our behavior even more fiercely in case we have a first-hand experience with a risk which has

> *'People are ruled by fear that cannot be rationally explained'*

turned into a reality, with a hazard that became a disaster. 'What we saw in the US is that the reaction depends on personal experience. In general, flood risk is not the first factor people think of when choosing where to live. Yet, if a person has experienced floods, the fear pops up and changes the course of thinking. They would avoid the hazard prone areas at all costs based on pure fear and not even consider living there anymore. We are rather rational until we have the personal experience with a disaster.'

## Natural born optimists

On the other hand, there is also a phenomenon called the optimism bias, explains Margôt Kuttschreuter, an expert on risk perception and risk communication from the BMS faculty. 'The first question people ask themselves about risks is: is it relevant for me? After all, we prefer not to deal with risks and danger and pretend bad things happen to other people, not to us. We prefer to live our lives, do something nice for someone else occasionally. This optimism bias is our way of dealing with the unpleasant thoughts about being harmed. A simple example of this is that one out of three people develops cancer, but you do not easily relate those figures to your personal situation. We usually have a too positive image of our own vulnerability, especially if no major negative events have happened to you. The moment you experience them, you realize how feeble your situation is.'

Yes, we tend to be afraid, especially during disasters. Kuttschreuter notes that it is important to know that people don't just behave like cattle. 'People act on the basis of very fast brain processes. I think a lot of people do indeed flee, which is a very sensible response. It is sometimes said that this is done out of sheer panic, but people in the risk research field say: it is a wise move. Besides, people don't only flee, but are also inclined to put themselves at risk to help others.'

## Honeymoon phase

After a disaster, a different kind of process arises, says Kuttschreuter. 'While people are in a kind of shock during a disaster, this is followed by a phase in which people mainly want to talk about the terrible stuff that happened to them. This is also referred to as the honeymoon phase. After, the rest of the world continues, they are

## *'Disasters will get out of hand if we don't transition'*

done listening and are already focusing on the next disaster. While the people who have experienced it take longer to process the suffering and being able to rebuild. Replacing property takes half a year to sometimes years, but the environment does not wait that long. By then, disaster victims tend to become disillusioned and take on a negative attitude. While the world keeps on turning, they stand still in between the rubble.'

With an exception of the direct victims, we usually tend to be forgetful creatures. 'We saw that house prices in the area after floods immediately drop, but within a few years they are back to normal. People just forget,' says Filatova. To explore how quickly people push unpleasant memories from their memory and 'go back to normal', Filatova's team ran a simulation model in which a flood would strike after a shorter period of time. This showed that, in such a case, people's reaction depends on their socioeconomic background. 'We saw that if the flood strikes let's say after two years again – before people forget – the number of low income households grows in the area, because higher income households move to a safer location. This leads to climate gentrification. The individual behavior of the households is not necessarily different. We all want to be safe and happy. But this is where the institutional aspect comes in. Poor people can't afford to move or to use the same protective measures as the higher income households and they are therefore forced to live in more dangerous and cheaper areas. People who live in the hazard prone areas often don't have the opportunity to leave. The real problem is inequality – even people with the same information react differently based on their socioeconomic opportunities. And this is likely to increase as climate change exacerbates.'

### 'Be informed and prepared'

Providing everyone with equal possibilities might be too much of a tall order, but is there anything we, regular individuals, can do to lower the risks? 'Be informed and prepared,' says Tatiana Filatova. 'You need to be aware of the objective risks that you are facing. Are you geographically located in a hazard prone area or are you in the age group that is more vulnerable to heat waves? Being aware is the first and most important stage. You need to be aware of the problem in order to find a solution. There are community based solutions that can be put into place then. For example, you can plant trees to provide shadow, you can isolate your houses, you can get green roofs and so on. There are many climate services available nowadays – digital channels with information specific to your area. The information is there if you want to find it.'

People don't always feel the need to find the information, though. 'At the moment I see a shift in society,' says Kuttschreuter. 'There is less acceptance that there are risks, and at the same time people assume that it will be resolved for them. It is one of the issues the Twente Safety Region is facing. How to push people in the right direction? Raise awareness of a threat. You have to tell them what they can do if something is wrong. You need to make people face the facts without frightening them. When that happens, other processes arise: denial. They are going to reason the risks away. Then you get examples such as smoking: "My grandfather smoked like a chimney, but has turned 95". In short: you have to make people aware of the risks and what they can do about it, without exaggerating. That's what works in the long term.'

### Fast and cheap solutions

The 'long term' is key here – and a concept that humans have trouble grasping, adds Kuttschreuter. 'By definition, people look at the short term, which is disadvantageous for reacting to climate change. That is something abstract, too obscure. People often choose to act in the short term. In addition, there is also the discussion about how easy or difficult it is to make an intervention in one's own living space. People are easier to persuade if something is simple and cheap.' Maarten van Aalst agrees: 'We know that we have limited time to lower emissions. Energy transition will play a major role in combatting climate change. But I also think that it needs to be made easy enough for people. We need the right technology so that people can embrace the change.'

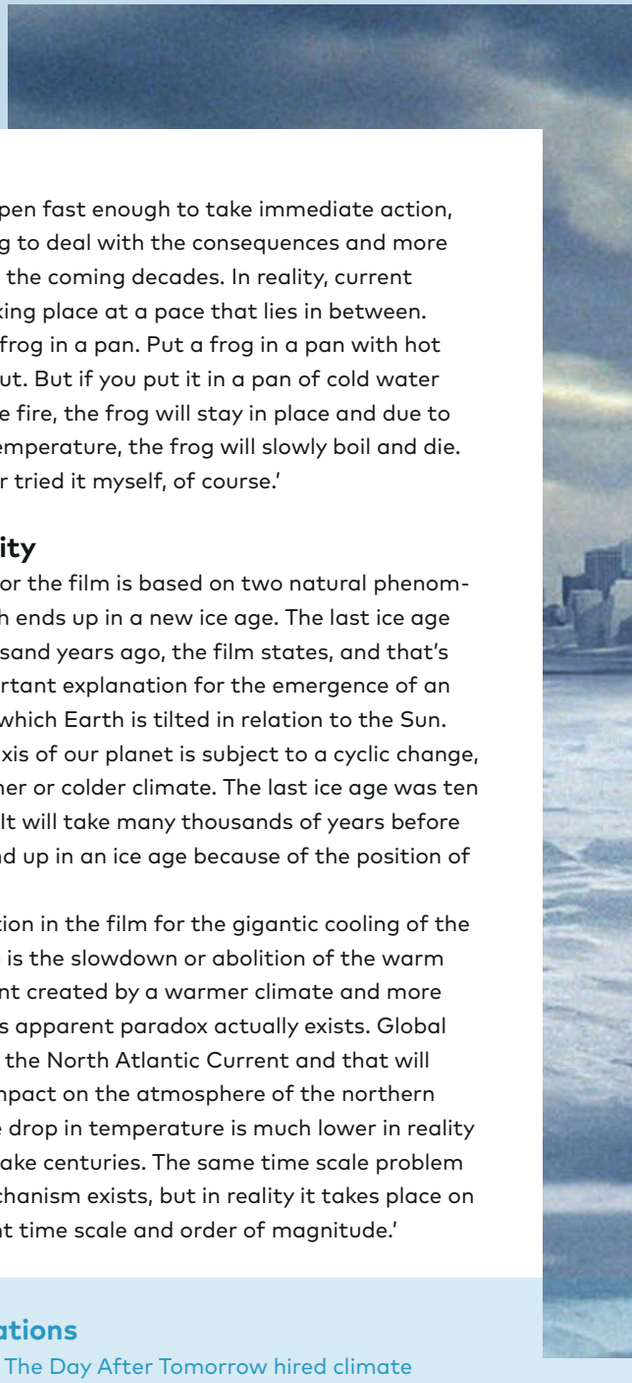
These 'small' individual adjustments will be necessary for creating a better and more resilient world. However, Van Aalst believes that large scale changes need to be implemented in order to protect this planet: 'Disasters will get out of hand if we don't transition and I am concerned about the energy transition not going fast enough and our ability to manage the consequences. Moreover, if the energy transition doesn't go fast enough, there are now technologies to artificially cool the planet. This approach is called geo-engineering. There are researchers working on solar radiation management, which means blocking the sunlight from reaching Earth. This is much simpler and more affordable than you might think. It could be achieved, for example, by dropping sulfur in the stratosphere – which is just what happens during volcanic eruptions. And just like with volcanic eruptions, it stays there for a couple of years. The problem is that you become addicted to this solution and it will influence many other things. There will always be side effects. You could expect it to affect rainfall patterns, wind patterns and so on. My second major concern is: what will our response be to the growing risks? Will we all be in it together or will we just take care of our own risks?' With the metaphorical one minute to midnight left, the four researchers agree that something has to be done. Without uniform recipe books for preventative measures, without cheating our way out of it by dropping sulfur in the stratosphere and without the ability to turn back time. Being resilient will not only come down to prevention and reducing risks, but our ability to get back up after we've been knocked down. Perhaps we'll have to be afraid of that becoming our reality. ●

### Experts who contributed to the article:

| | |
|---|---|
| **MAARTEN VAN AALST** | Professor of Spatial Resilience for Disasters Risk Reduction, ITC faculty |
| **TATIANA FILATOVA** | Professor in Computational Resilience Economics, BMS faculty |
| **RICHARD SLIUZAS** | Professor of Urban Planning for Disaster Risk Reduction, ITC faculty |
| **MARGÔT KUTTSCHREUTER** | Assistant professor at the Department Psychology of Conflict, Risk and Safety, BMS Faculty |

# POP CULTURE

**We binge-watch one Netflix series after another, we devour movies and games. Often it is no more than mindless entertainment, while at other times it even raises scientific questions. Pop culture, viewed through the eyes of a scientist.**



This time, Vasily Kokorev, a researcher at ITC and KNMI (the Royal Netherlands Meteorological Institute), and an expert on rapid climate change, shares his views on the movie The Day After Tomorrow (2004). If you have not watched this movie yet, beware of spoilers!

## The plot

During a crowded hearing, paleoclimatologist Jack Hall (Dennis Quaid) warns the vice president of the United States about the far-reaching effects of climate change. The politician reacts furiously: 'Do you know how much money your plans will cost!' The film scene would not have been out of place in 2019 either, but it comes from The Day After Tomorrow, a 2004 Hollywood blockbuster. In the film we see how Earth is cooling down rapidly due to the melting polar ice caps. Yes, really: cooling down. The northern hemisphere ends up in a new ice age within a few days, with all the consequences that entails...

## First impression

Kokorev: 'The film was relevant to me in a strange way, since I do research into rapid changes in the climate in Southeast Asia. The film has a scientific twist, but is clearly a Hollywood production. I would like to characterize the film as climate fiction. Some ideas have a scientific basis, but the time scale is incorrect. The incorrect time scale was something I particularly noticed: in the film, climate change is initially presented as something in the distant future, over hundreds of years, such as when the vice president dismissed the warnings from the climatologist, but it happens catastrophically within a few days, which is what the plot of the film ultimately revolves around. This is often the case in popular stories: the protagonist is confronted with a classic major problem, in this case the (near) demise of Earth. Such a large but simple problem with a clear time scale makes it easy to follow for the viewer.'

'While it doesn't happen fast enough to take immediate action, we are already having to deal with the consequences and more problems will arise in the coming decades. In reality, current climate change is taking place at a pace that lies in between. Compare it with the frog in a pan. Put a frog in a pan with hot water and it jumps out. But if you put it in a pan of cold water and then put it on the fire, the frog will stay in place and due to the slow change in temperature, the frog will slowly boil and die. Although I have never tried it myself, of course.'

## Realism/feasibility

'The scientific basis for the film is based on two natural phenomena. First of all, Earth ends up in a new ice age. The last ice age was around ten thousand years ago, the film states, and that's right. The most important explanation for the emergence of an ice age is the way in which Earth is tilted in relation to the Sun. This position of the axis of our planet is subject to a cyclic change, which causes a warmer or colder climate. The last ice age was ten thousand years ago. It will take many thousands of years before we will once again end up in an ice age because of the position of the axis of Earth.'

'The second explanation in the film for the gigantic cooling of the northern hemisphere is the slowdown or abolition of the warm North Atlantic Current created by a warmer climate and more fresh melt water. This apparent paradox actually exists. Global warming is affecting the North Atlantic Current and that will eventually have an impact on the atmosphere of the northern hemisphere. Only the drop in temperature is much lower in reality and the change will take centuries. The same time scale problem applies here: the mechanism exists, but in reality it takes place on a completely different time scale and order of magnitude.'

## Stray observations

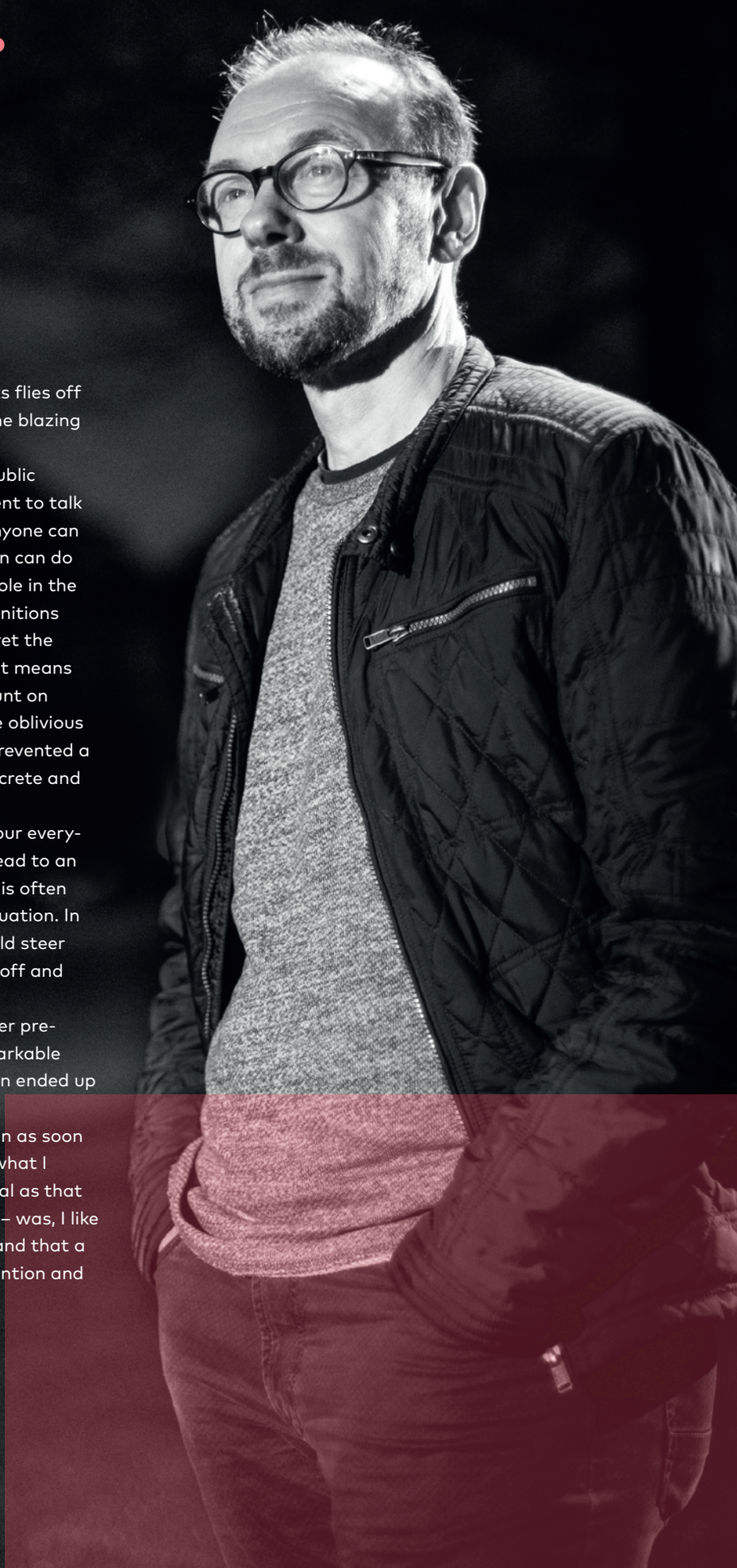
- 'The creators of The Day After Tomorrow hired climate expert Michael Molitor. He called the film his most important work in his career as a climatologist. I understand this statement. The problem of climate change is made clear by the film (although the scientific basis is not entirely correct) for a large audience. It has been dramatized, but everyone knows that this is how it goes with a Hollywood film.'
- 'In the film, the climatologist presents his findings directly to a politician, which will properly never happen in reality. I noticed that when I was working on the IPCC report prepared

Text: **Jelle Posthuma**

Still from the film The Day After Tomorrow.

by the United Nations (UN) climate panel. The most read part of the IPCC Report (The Summary for Policy Makers) is not the most important message from scientists, but rather the result of negotiations by the teams of lawyers from every country. This process of writing softens the message significantly and completely removes the most inconvenient findings from the summary. For me, the scenes where the protagonist presents his findings to the UN and later to the vice president was probably the least believable moment in the whole film.'

# Preventing disasters ourselves



As the plane begins to pick up speed, a shower of sparks flies off the rapidly spinning wheels. A short time later, I see the blazing landing gear disappear inside the nacelle...

We prefer to leave disaster prevention to others, such as our public administrators and scientists. However, I want to take a moment to talk about preventing disasters ourselves. It sounds difficult, but anyone can do it, even you. I will admit that there is not a lot a single person can do against an earthquake or a flood. The proverbial finger-sized hole in the dyke does not exist. Yet what is a disaster, exactly? Formal definitions refer to an event with many victims and widespread damage, yet the Talmud says: 'Whoever saves a life, saves the entire world.' That means anyone can prevent disasters. When you do, you should not count on applause. The disaster never happened and most people will be oblivious to the danger you averted. However, the knowledge that you prevented a disaster should be reward enough in and of itself. Let's get concrete and go to work.

The general principle behind my 'method' is that something in our everyday lives that looks dangerous is indeed dangerous and could lead to an accident and therefore a disaster. When things go wrong, that is often because no one took the trouble to do something about the situation. In other words, when you see a fallen branch on the road, you could steer your bike around it and go on your merry way, or you could get off and move it aside. It is really that simple.

I do not mean to imply that I am in any way an expert in disaster prevention. I once spent fifteen minutes observing someone's remarkable behaviour while slowly sipping my coffee. The person in question ended up drowning.

My plane never caught fire, but the wheels began to spark again as soon as it touched down. When I got off, I told a stewardess about what I had seen. 'Thank you, but that is quite harmless.' As professional as that response – clearly intended to calm down a worried passenger – was, I like to imagine that my warning was taken seriously by the airline and that a disaster was averted because of it. All that, just by paying attention and speaking up.

**Wiendelt Steenbergen**
*Professor of Biomedical Photonic Imaging*

E

Everyday Science

# Why a teapot drips

Do you ever take the time in your busy life to wonder about everyday phenomena? Things that are obvious to us, or perhaps just make for a handy trick? Nevertheless, there is always a scientific explanation for such phenomena. In Everyday Science a UT researcher sheds light on an everyday topic.

Text: **Rik Visschedijk** Photo: **Shutterstock**

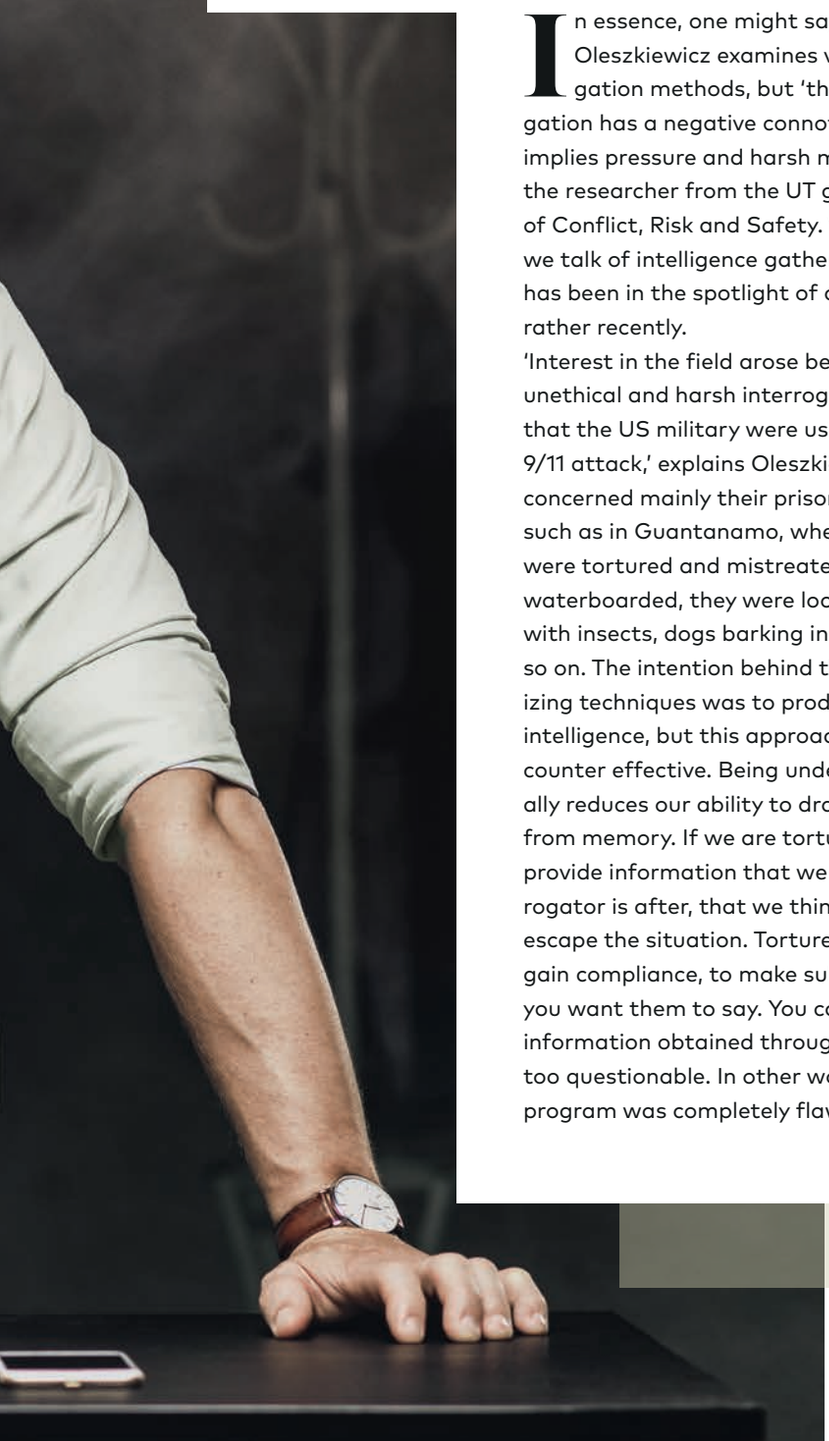
It might not be a particularly existential question, but it is a phenomenon that mankind has had to deal with since it first invented pots and pans: the dripping teapot. Even our earliest ancestors knew that it is virtually impossible to pour tea or some other liquid without spilling a drop.
It took until the 1950s for the first scientific articles about the 'teapot effect' to appear, says UT professor Jacco Snoeijer of the Physics of Fluids department. 'They were unable to find the answer, though. The scientists hardly considered the coating of the spout: is it water-repellent or not. However, that is where the answer largely lies.'
Snoeijer has been wondering about this for some time now. 'Not every single day, of course, but still,' he says. 'The fact that I could not let go of this was due to a French research group, who demonstrated back in 2009 that you will spill a lot more when the spout is made of a material that the water can easily cling to. Unsurprisingly, two examples are glass and earthenware.'
However, a conclusive theory, one that can predict when and how much fluid will 'stick,' did not exist yet. 'Colleagues at the University of Amsterdam were cleaning their tools,' Snoeijer continues. 'They noticed that the stream of water formed a helix around a needle and therefore slid down in a circular shape. At the same time, we were hard at work here in Twente to explore this phenomenon as well. Then it was simply a matter of combining our efforts.'
No teapots were used in the research. 'We conducted our experiments with cylinders of different sizes, which we directed jets of water onto,' Snoeijer explains. 'The curvature of the cylinder is an excellent representation of a teapot's spout.' The result: when using a thin cylinder and a high-speed jet of water, the water will deflect somewhat, but nothing much will happen. 'The thicker the cylinder and the lower the flow rate, the more the water curves around the cylinder. As a result, the water will flow down in a helix-shaped pattern.'
'To get away from the surface of the cylinder, the water has to break free,' Snoeijer continues. 'The sharper the curvature, the easier the fluid will let go. That means there are a number of factors in play: sharp edges and a high flow rate. However, the material used also plays a part in the matter.'
Snoeijer does not expect this discovery to lead to no-spill teapots any time soon. 'However, it also has other, more direct applications. One example is printing with ink, because you want all the ink to end up on the paper, instead of sticking to the print head. The same applies to the printing of fibres and plastics.'

SIMON OLESZKIEWICZ TRAINS POLICE AND MILITARY

# Secrets of the *'Master Interrogator'*

Text: **Michaela Nesvarova**
Photos: **Rikkert Harink**

**Simon Oleszkiewicz's interest in psychology was sparked about thirteen years ago when he worked as a caretaker in a mental hospital for convicted criminals. Surrounded by murderers and child molesters, he decided to delve deeper into the human psyche. Now the Assistant Professor at the University of Twente researches effective interview techniques for intelligence gathering. He uncovers the principles behind 'master interrogation', developing training for the police and military.**



In essence, one might say that Simon Oleszkiewicz examines various interrogation methods, but 'the word interrogation has a negative connotation because it implies pressure and harsh methods,' warns the researcher from the UT group Psychology of Conflict, Risk and Safety. Which is why we talk of intelligence gathering, a field that has been in the spotlight of academics since rather recently.

'Interest in the field arose because of the unethical and harsh interrogation methods that the US military were using after the 9/11 attack,' explains Oleszkiewicz. 'This concerned mainly their prisoners abroad, such as in Guantanamo, where prisoners were tortured and mistreated. They were waterboarded, they were locked in rooms with insects, dogs barking in their faces and so on. The intention behind these dehumanizing techniques was to produce actionable intelligence, but this approach is in fact counter effective. Being under pressure actually reduces our ability to draw information from memory. If we are tortured, we will only provide information that we think the interrogator is after, that we think will allow us to escape the situation. Torture is effective to gain compliance, to make subjects say what you want them to say. You can't rely on the information obtained through torture, it is too questionable. In other words: the torture program was completely flawed.'

## Ethical and effective

According to the scientist, the aftermath of the 9/11 attacks highlighted a big gap in science and knowledge base for intelligence gathering. 'There was actually no research into what are effective and ethical forms of intelligence gathering,' he says. 'In 2009, president Obama gave an executive order to fund research into this topic and, thanks to that, researchers like me began creating scientific knowledge on intelligence interviewing, understanding the underlying principles, what techniques are effective, understanding why particular interrogators were consistently successful and trying to find the systematics behind their approaches. We want to nail down what works and what doesn't.'

While president Obama was creating the FBI-led High-Value Detainee Interrogation Group, encouraging research into new forms of intelligence gathering, Simon Oleszkiewicz, still in his home country of Sweden, was busy with another fascinating research topic: deception detection. 'At the mental hospital I was working with criminals,

*'The torture program was completely flawed'*

with people who I – beforehand - thought would be monsters. But being around them, I realized they were not monsters. They had problems that had led them to a negative state of mind, but most of them were not bad all through their core. In my opinion they were mostly extreme deviations of normal personality traits. At least I perceived it that way and I wanted to understand it better. I started a psychology course and found a study on deception detection. It really blew my mind. The researchers showed how bad we are in detecting deception, and their comprehensive study was a master challenge to a common quick fix in policing; the belief that we can immediately spot a liar based on his or her bodily reactions. Yet, there is still such a drive in humanity to be able to detect deception. That study really opened my eyes. I found this very fascinating and I looked up my professor Pär-Anders Granhag in Gothenburg who was – and still is – an expert on deception. It was he who suggested a new research line for me: intelligence gathering.'

### Learning from the German Luftwaffe

And how better to start learning about successful intelligence gathering methods than by studying the techniques of so called 'Master Interrogator', Hanns Scharff? Scharff was a German Luftwaffe interrogator during the Second World War. His ability to gain information from captured fighter pilots without the use of any physical (or unpleasant) means was legendary. In 1948, Scharff was even invited to Pentagon to give lectures on his interrogation techniques. The U.S. military later incorporated his methods into its curriculum at its interrogation schools and many of them are still taught in the US Army. The 'Scharff technique' is also the base of the training that Simon Oleszkiewicz is currently developing for police and military officers.

'People used to accept that Scharff's effectiveness was due to his personality and natural ability to befriend his enemies,' says the UT researcher. 'But that is not the full story.' Oleszkiewicz has studied the German interrogator's methods and he uncovered specific tactics behind Scharff's success. 'The key to Scharff's success was that he made the prisoners believe that their defense strategies were still working well enough, and he capitalized on that.' He used a friendly approach, bonding with the prisoners. He'd take them for walks, get them cigarettes and let them read newspapers. Besides kindness and respect, Scharff used another important tool: storytelling. 'He never asked explicit questions – because that would show what information he was after,' explains Oleszkiewicz. 'Instead, he would tell a story, giving the prisoner the opportunity to add details to it, without fully understanding when they contributed to the story.'

### Police, military, FBI

Using these 'secrets of the master interrogator' and his other research, Oleszkiewicz is now working with law enforcement agencies in the US, the Netherlands and Scandinavia, including the Dutch national police and soon hopefully also a new research contract with the FBI. The scientist is developing evidence-based training for these professionals and has already trained and lectured about the technique to police and military officers in Sweden, Norway, Denmark, the US,

## Example of a successful intelligence gathering by Hanns Scharff

(described in book The interrogator: The story of Hanns Joachim Scharff master interrogator of the Luftwaffe. By Toliver, 1997, page 103)

**Conversation between:**

Hanns Scharff and captured pilot Lieutenant Richard Price Jr.

**Setting:**

a long conversation during a walk outside, preceded by a discussion about the different ways of life between Americans and Europeans

**True purpose of the conversation:**

to find out why American fighter pilots fire white tracer bullets right before they return to their home base

Scharff: 'It is too bad America did not have more experience in working off English bases as it sometimes overloads your industry back home, such as they now have run out of the chemicals they use to make red tracer bullets. Those white ones you fellows are using in your dogfights must be rather hard to follow with your eyes so you have to shoot a whole string of them...'

Price: 'Ha! You're nuts, Hanns, they haven't run out of much of anything back home. White tracers are just our own way of warning ourselves. When ten of them, or any big batch of them shows up, you know you'd better start heading for home pronto because you have just shot out your last ammo. The guns are empty.'

the UK, and South Korea. 'We've shown that those who we've been trained in our techniques, outperform their colleagues,' he says. 'What we've observed is that, if the training is applied, the interviews are shorter, more new information is collected and less questions are asked during the interviews. The professionals tend to focus on the motivation of the interviewee, but with our training their focus turns more to the interaction or relationship, which seems to relieve some pressure from the interviewee.'

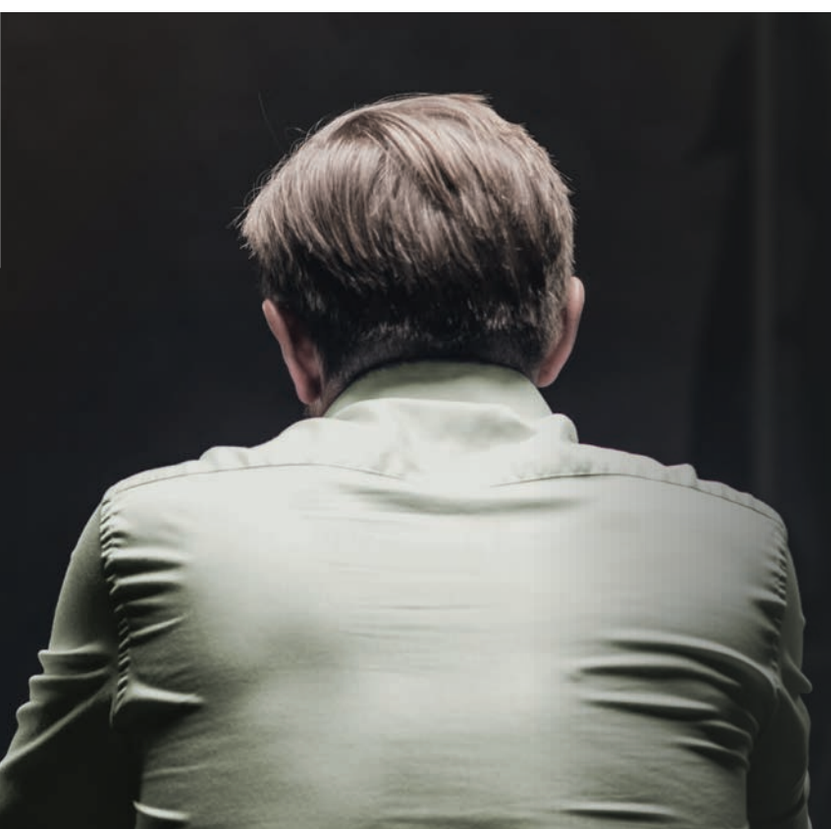
Is focusing on the interaction the key? What constitutes an effective interrogation? 'Positive interview atmosphere in which the interrogator honors the subject's autonomy and emphasizes shared challenges. Saying things such as "I see that you are in a difficult position, but so are we." The interrogator should make sure that the subject knows that he or she has a freedom of choice, that they are not forced to respond if they do not wish to do so. The interview needs to be built on a mutual respect,' answers Oleszkiewicz.

'There is no simple trick to it,' he adds. 'It's about finding the topic that is important to the subject and being willing to tactically share knowledge. For example, an FBI agent Ali Soufan described his interrogation of Bin Laden's lieutenant. The lieutenant was very resistant. He was waterboarded 183 times by the CIA and didn't give up any information, and so Soufan knew he needed a different approach. During an interview, he called the lieutenant by a nickname only his mother used. By doing so, the prisoner believed that Soufan must have much more information than he actually had because he knew about this nickname that nobody except his own mother knew.'

*'The interview needs to be built on a mutual respect'*

## The real world

Working with the police and other practitioners is what drives Simon Oleskiewicz's research. 'My research focus always comes from real examples, from the field,' he says. 'But I see myself in academia. This is where I found my passion. My immediate goal is to establish myself as a researcher, to get funds to investigate my own ideas. I want to continue with applied research and see how much I can improve practice. I want my work to be helpful to professionals, rather than criticizing what they do. I firmly believe that if you want to be a good interrogator, you need the real-life experience, you have to allow yourself to make errors and then adjust to improve yourself. The people I work with have that. I can never beat them in interrogation skills, but I believe I can help explain why their methods work so that they can use them even more effectively. I want to see the effects of my work in practice, but I want to keep my feet in academia.' ●



**Simon Oleszkiewicz (1982):**

| | |
|---|---|
| 2018 – now | Assistant Professor, Psychology of Conflict, Risk and Safety group at the University of Twente |
| 2018 | Early Career Award, European Association of Psychology and Law |
| 2016 – 2018 | Postdoctoral researcher, Iowa State University |
| 2016 | PhD in Psychology, University of Gothenburg, Sweden |

*Science is all about making choices. Some lines of research achieve great success, while others die unlamented deaths. Back to history delves deep into the archives looking for developments with historical relevance. This time we look at the origins of the Doomsday Clock.*

# Doomsday Clock

Text:
**Rik Visschedijk**

It is two minutes to midnight on the 'Doomsday Clock' – metaphor for the end of the world. That warning, issued by prominent scientists in the Bulletin of the Atomic Scientists, is the same as the one that was given the year before. That is why this constant threat against humanity is called 'the new abnormal.' That abnormal situation has become commonplace. In the process, it has taken us to the edge of the Apocalypse. Scientists point to two dangers resulting from uncontrolled scientific and technological progress: nuclear weapons and climate change. Either could spell the end for us all. The mounting 'information war' that undermines our democracies only exacerbates the threat. 'The longer the world's leaders and people allow this abnormal reality to persist, the bigger the chance that the world will experience a catastrophe of historical proportions,' they write in an open letter.

Before 2018 and 2019, the clock had only been set to two minutes to midnight once before: in 1953, after the development of the hydrogen bomb. Ivy Mike, as the weapon was called, was detonated on 1 November 1952. Its explosive force was more than that of all the bombs dropped by the Allied forces during the entire Second World War. During that time, with the Cold War in full swing, the clock remained at two minutes to midnight until 1960. Once the United States and Russia reopened communications, the dials could be moved four minutes back.

The Bulletin of the Atomic Scientists was founded in 1945 by scientists who had worked on the Manhattan project to develop the first nuclear bomb. Under the supervision of Julius Robert Oppenheimer, they were engaged in a race against the clock to stay one step ahead of the Nazis. Disillusioned after the destruction of Hiroshima and Nagasaki, they came together to inform researchers, politicians and the general public about the dangers of what they had created. Armed with both technical and humanist arguments, they advocated for the elimination of these highly destructive armaments.

These days, the scope of the Bulletin scientists goes beyond nuclear weapons. Climate change, artificial intelligence, biological threats and geopolitics are all just as relevant for the continued existence of the human race. The Bulletin believes that scientific and technological progress should improve life on Earth, not make it worse.

Jerry Brown, the new chairman of the Bulletin, compares the time we have left to the fateful journey of the Titanic. 'We are like passengers on the Titanic, ignoring the iceberg ahead, enjoying the fine food and music,' he said earlier this year. He was referring to the withdrawal from geopolitical treaties, the expansion of Russia's and the United States' nuclear arsenals and the political unwillingness to take serious measures against climate change. ●

*Ruchi Bansal*

# Fixing the world's liver problem

Text: **Michaela Nesvarova**
Photo: **Rikkert Harink**

'One quarter of the world population is affected by non-alcoholic fatty liver diseases. They are now the main cause of liver transplantations,' says Ruchi Bansal, who is developing new treatments for these and other liver diseases. The Assistant Professor has recently established an independent group 'Liver Lab' at the UT's Department of Biomaterials Science and Technology.

But the ambitious scientist is aiming even higher. Soon she plans to run a start-up and bring new liver therapies to the market. 'My main goal is to develop effective and safe therapies to treat patients, because both alcoholic and non-alcoholic fatty liver diseases are on the rise. They are replacing hepatitis C as the major liver-related concern. About 10% of affected patients progress to liver failure, so it is becoming a big problem,' says Bansal. 'This is all mainly due to unhealthy lifestyle: fatty diet and alcohol abuse. The diseases could therefore be cured by a change of lifestyle – or by a new therapy.'

The scientist is working on the second option and she is making progress. 'Normally drugs, once administered, are distributed throughout the body leading to therapeutic effects but also side effects. Because of the wide-spread bodily distribution, the administered dose is higher than the effective therapeutic dose required. We can reformulate these drugs into organ-specific and cell-specific nanotherapeutics. We have tested these nanotherapies in animal models and the results were positive. It will, of course, take years before the treatment reaches patients, but it looks promising. Since liver diseases are a major economic burden, there is a huge market potential,' she says. 'Once we have an even better proof of concept and more safety studies, I plan to launch my start-up TarMac Technologies for which I have already received a seed funding from NWO.'

The researcher believes that she has a fair chance of succeeding on her quest. 'We have an enthusiastic "Liver Lab" research team dedicated to liver disease modelling and generating new treatments.' A lab that Bansal started earlier in 2019. 'Having students drives me. I focus on talent development and aim to give my students the best chance for their future.' ●

## Our 'Rising star' Ruchi Bansal:

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|---|---|
| 2019 | Hind Rattan Award |
| 2018 | AASLD Young Investigator award |
| 2017 | UEG national scholar award |
| 2016 – now | Assistant Professor (UT Department of Biomaterials Science and Technology) |
| 2016 | Gastrostart Grant from Netherlands Society of Gastroenterology |
| 2014 | VENI grant |
| 2012 | Postdoctoral researcher at the UT |
| 2011-2012 | Sheila Sherlock research fellowship and The Ruth and Richard Julin's Swedish Foundation research grant |
| 2007-2011 | PhD in Pharmacokinetics, Toxicology and Targeting, University of Groningen |

# THE LAB

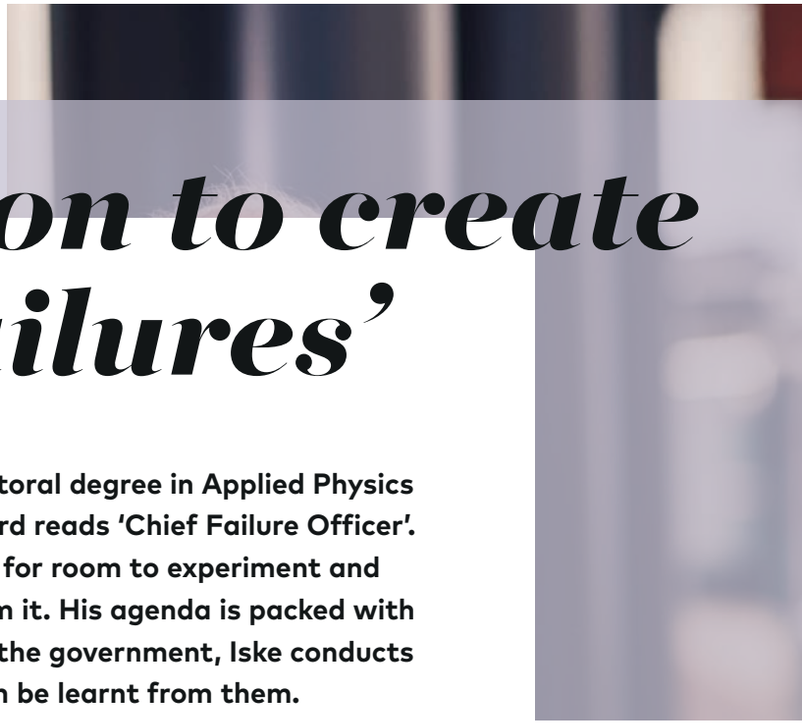
## BMS Lab

'A catalyst of state-of-the-art technology for social sciences.' That's how Jan-Willem van 't Klooster, BMS Lab's managing director, describes the BMS Lab. On the second floor of the Cubicus, there is about 400 square meters for researchers and students to experiment, rent mobile equipment, and get help, advice and inspiration. 'The role the BMS lab plays can be a


Text:
**Rense Kuipers**
Photo:
**Rikkert Harink**

simple one, like lending VR glasses or audio transcribers, to setting up eye tracking experiments and developing entire virtual reality worlds,' says Van 't Klooster.
Ever since the BMS Lab moved from The Gallery to Cubicus, the number of yearly projects has risen from 80 to about 200. Mostly in cooperation with researchers from the BMS faculty, with occasional collaborations with the TechMed Centre and EEMCS. The latest addition to the BMS Lab is a mobile laboratory, in the form of a large van. According to the Managing Director, it's inevitable the lab will continue growing. 'It's up to us to make sure the research groups will keep on getting the right equipment, inspiration and support. We're a young lab that will have to keep reinventing itself.'

Text: **Rik Visschedijk** Photos: **Christiaan Krouwels**



# *'It is my mission to create a place for failures'*

**Paul Iske (1961) obtained his cum laude doctoral degree in Applied Physics from the UT, but these days his business card reads 'Chief Failure Officer'. His Institute of Brilliant Failures advocates for room to experiment and fail, as long as you do it right and learn from it. His agenda is packed with lectures. For various institutions, including the government, Iske conducts research into failed initiatives and what can be learnt from them.**

There is a lot of money to be made with brilliant failures. When Iske opens the door of his waterside residence in Oostzaan, he has to excuse himself right away. He is talking to a client on the phone who has asked him to research a recent failure. 'Of course, there are countless management consultants who understand exactly what topics do well at the moment,' he says when he hangs up the phone. 'However, I have been working on the cutting edge between knowledge, creativity and innovation for years. I am glad that my perseverance is appreciated and that people recognise the reputation I have built.'

## The baby and the bathwater

Iske's mission is to develop a 'language' with which to describe brilliant failures. Just think how many initiatives are lost to history? 'We are throwing out the baby with the bathwater when we do nothing with failed projects,' Iske says. 'There are so many factors that play a role in a project's success or failure. It is about much more than simply having the right idea. A novelty requires support, the right timing and collaboration, to name just a few factors.'
Here is an example: In 1996, Iske developed a predecessor of the current LinkedIn for his former employer Shell. 'The idea was simple and good,' he reflects. 'A multinational like Shell has a lot of in-house expertise, except people don't know what their colleagues know. We decided to create a database where all those people and their expertise could be found, alongside some personal information so you know whom you are dealing with. Together with a business partner, I wanted to bring this system – which we called In MASTER (MApping SysTem for ExpeRtise) – to market. What could go wrong?'
It was not a success. 'Everywhere we went, we were told that our idea was nice, but we first had to help them set up a proper intranet. The internet was still in its infancy. Businesses and institutions were just starting to think about what to do with it. We were simply too early, because LinkedIn did manage to conquer the market six years or so later. I learned an important lesson from that failure: good timing is paramount and being too early with your innovation is not the right time.'

*'Hardly anyone ever talks about their failures'*

## Failing brilliantly

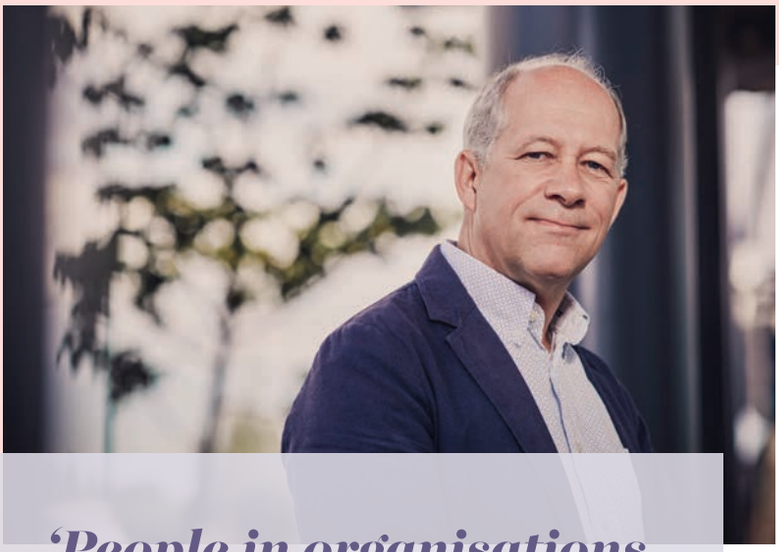
With his Institute of Brilliant Failures, he has put this experience to good use. In his recent book, which bears the same name, he paints scenarios to avoid failures. He also advocates for the taking of acceptable risks. 'You can fail brilliantly when you did everything right and still don't quite make it. Nevertheless, a lot of value was created during that process. Take the discovery of Viagra, for example, which was intended to be used as heart medicine. In this case, it was turned into a product that helps people. If the creators had failed to realise its potential, however, all that knowledge would have been thrown out.'
Iske's passion is to give people and organisations the trust they need to take risks. After graduating cum laude from the Applied Physics programme at the University of

# *'You can fail brilliantly'*

PAUL ISKE

**Paul Iske**

| | |
|---|---|
| 1961 | Born in Amsterdam |
| 1985 | MSc, theoretical physics and mathematics, University of Amsterdam (cum laude) |
| 1989 | PhD, theoretical physics, University of Twente (cum laude) |
| 1989 - 1996 | Senior research physicist, Shell |
| 1997 - 2015 | Chief Dialogues Officer, ABN AMRO |
| 2008 | Chief Failure Officer, Institute of Brilliant Failures |
| 2010 | Professor of Open Innovation and Business Venturing, School of Business & Economics, Maastricht University |



*'People in organisations understandably focus too strongly on the risk of damage'*

Amsterdam, he came to Twente to obtain his doctoral degree under professor Wim Caspers. 'I got my PhD, with distinction, after four years,' he says. 'Still, I had no desire to continue, because I wanted to see more of the world. Mostly, I realised that I am probably not the world's best researcher. I was not looking forward to being a second-class scientist, which would have been all I could have managed.'

## The language of mathematics

Iske left for Shell. 'I got a job as a researcher. In that prosaic environment of oil refineries and the ugliest machines and factories imaginable, I discovered a wonderful underlying world of mathematics. One of the things I did was work on a catalytic cracker. The tank had to be cleaned by hand every time because particles would stick to the walls. No one knew why that happened. Together with a Russian colleague, I suddenly realised that the process could be described mathematically in the same manner as a satellite in space, which is positioned in the gravitational field of two celestial bodies – the method of 'Matching Asymptotic Solutions.' With that knowledge, we were able to describe the process that occurred inside that cracker using the language of mathematics.'

Iske realised his true interest was the search for new answers to existing challenges. After seven years at Shell, he left for ABN AMRO. 'When my son passed away in an accident, a member of the board of directors told me to take some time, go outside and think about what I truly wanted. That was when I founded Dialogues and called myself Chief Dialogues Officer. I brought people with diverse backgrounds together – not with the goal of tackling predefined problems, but simply to put them in the same room and have them find the connection on their own. That is how the most interesting ideas are born.'

As Chief Dialogues Officer, Iske came into contact with Maastricht University, where he got a job as a professor of Open Innovation one day a week. At the Maastricht University School of Business and Economics, he focuses on 'Combinatoric Innovation.' 'We study opportunities to stimulate dialogue with regards to knowledge. I do so by first determining what knowledge you have and putting it together. A kind of business plan in reverse, simply put. It is not an efficient method, but it is exceptionally effective nonetheless.'

## 'View a research proposal like a business case'

These days, Iske combines his Institute of Brilliant Failures with his professorship. His educational background gave him an analytical perspective. When he looks at the academic world, he sees a strong focus on success. 'I am always surprised to see that acquiring a grant is a cause for celebration, even though that is only the beginning,' he says. 'With any research, you face many uncertainties. You can recognise these uncertainties by viewing a research proposal more like a business case. That means you do not have to go as deep and the researcher will receive 'seed money,' instead of getting the entire sum in one go.'

Iske says it is all about daring. In March, he gave a talk during the National Research Agenda's 'Innovative Risks or Risky Innovation?' conference. He took the example of the Idea Generator, where researchers can receive a sum of fifty grand for their 'risky' projects. 'I showed images of seven researchers who had all been killed by their own invention; from a cancer researcher who died of a radiation overdose to a researcher of radioactivity. Talk about 'high risk – high gain' research.'

## Distorted worldview

The academic world's strong focus on success results in a distorted worldview, Iske says. It is not unlike the news. 'When you watch the evening news, you might start to believe the world is constantly in crisis. The world of science does the reverse: it sums up its successes, yet hardly anyone ever talks about their failures. It is my mission to create a place for failures. That requires an instrument that tells you which failures are brilliant, because laziness or a lack of interest are not.'

'However, once that language exists,' Iske concludes, 'you can truly learn a lot from failures. You also allow the people in an organisation to try something genuinely new, because they are not judged on their success or lack thereof, but rather on the process leading up to it. People in organisations understandably focus too strongly on the risk of damage. They are afraid that a failure will haunt them for the rest of their career. That is a surefire way to kill innovation. People should be given the opportunity to fail brilliantly; you can get so much out of that.' ●

Text: **Jelle Posthuma** Photo: **Rikkert Harink**

M

**Master Research**

## Helmer van den Hoorn researched rollercoasters

# *'Too many G's can be dangerous'*

Who hasn't spent part of their childhood building rollercoasters in RollerCoaster Tycoon? For Master's student of Mechanical Engineering Helmer van den Hoorn, it did not end there. He did his final thesis project at Intamin Holland in Apeldoorn, a company that specialises in calculating rollercoasters and other theme park rides.

Van den Hoorn's (23) love of rollercoasters was born at an early age when he discovered the rollercoasters made of K'NEX. With those construction materials, he was able to build accurate scale models of real rollercoasters. 'Things got quite out of hand, because the possibilities are endless. Over the years, I have built scale replicas of several real-life coasters, ranging from a wooden rollercoaster to a suspended model.'

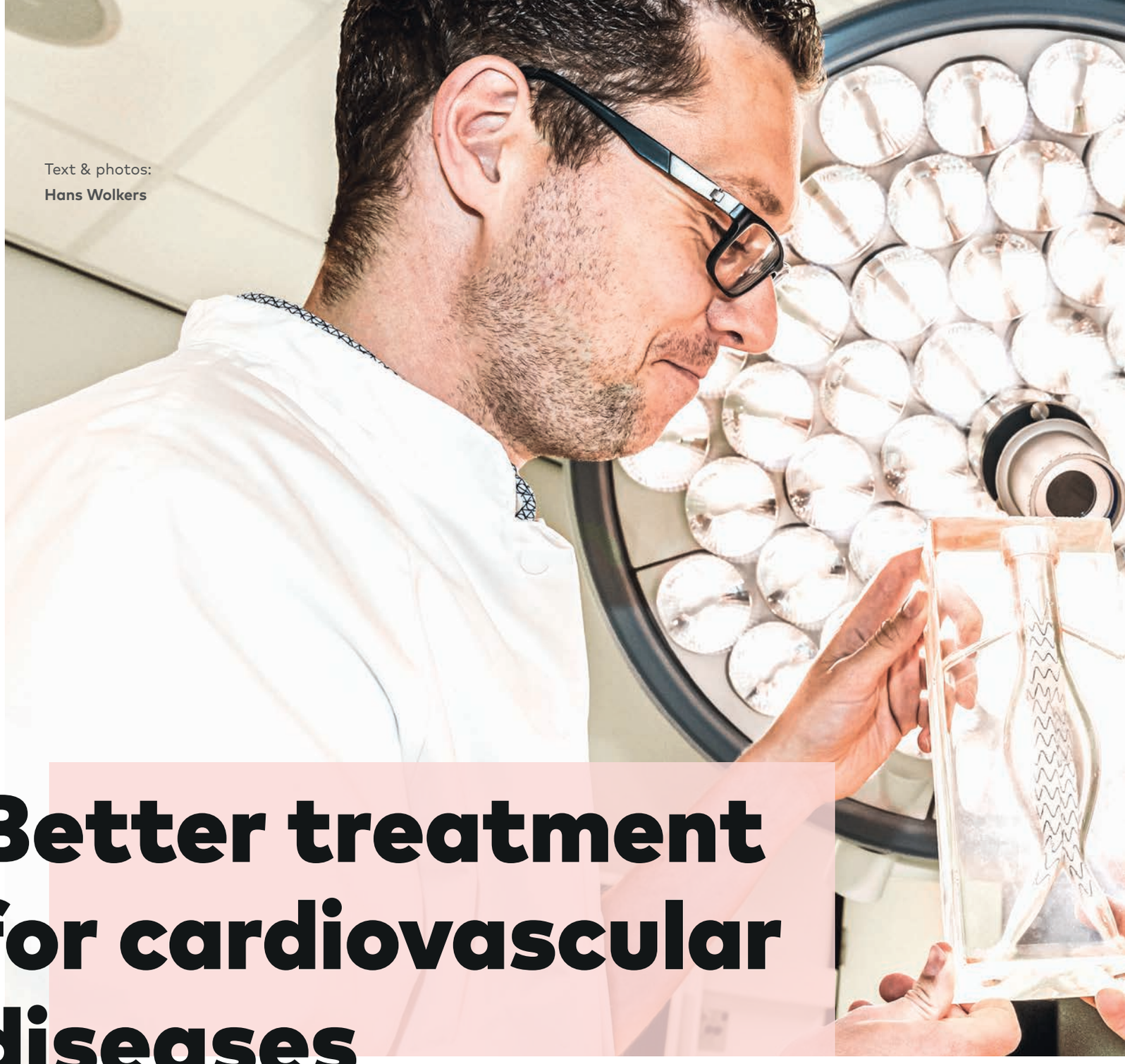
'It was my dream to ultimately get a job at a rollercoaster manufacturer. However, when I learned that most of the businesses in that sector are based in southern Germany, Switzerland and the US, I thought it would never be more than a dream – until I heard about Intamin in Apeldoorn. This company calculates rollercoasters and other theme park rides for its parent company in Switzerland. One famous example is the Goliath in Walibi. My lecturer Jurnan Schilder knew the director of the company and because of that connection, I was able to start my final thesis project in a matter of weeks.'

'A theme park has an idea or a concept for a new ride. Intamin in Apeldoorn then calculates the possibilities. What is the maximum load for the chain that has to pull up the rollercoaster's cars? How thick should the beams that support the track be? What G-forces affect the passengers? A few Gs are fun for thrill seekers, but too many can be dangerous.'

'During my final thesis project at Intamin, I worked on a project about a spinning coaster. With this model, the gondola can spin freely around its axis. I built a model of the coaster in a simulation programme and then gathered a wealth of data. These data allow us to calculate the minimal required bearing strength of the frame's beams, for example. I was working on a method to translate the forces and moments into criteria for the load in a more accurate manner. Using this method, the tensions in the material can be calculated more precisely without a significant increase in processing time.'

'My final thesis project fits well within the research into rollercoasters that UT lecturer Jurnan Schilder is working on. He supervises me from the university. His ultimate goal is to develop a model that simulates a rollercoaster as accurately as possible and with a minimal degree of uncertainty. Sometimes, a rollercoaster experiences fewer Gs in real life than in the simulation. In other words, it could have been even more spectacular. However, the G-forces may also be higher than expected, in which case part of the track has to be rebuilt.'

Text & photos:
**Hans Wolkers**



# Better treatment for cardiovascular diseases

**Vascular surgeon Professor Michel Reijnen from Rijnstate in Arnhem and Technical Physician Erik Groot Jebbink from the Multi-Modality Medical Imaging group of the UT are developing new methods to measure blood flow profiles. These play an important role in the development of vascular diseases. The scientists aim to link blood flows with the occurrence and development of cardiovascular disease for a more effective long-term treatment.**


*'We can calculate and model blood flow profiles in vitro'*

'With this in vitro set-up we can measure the fluid flow profiles in silicon models of blood vessels.' UT scientist Erik Groot Jebbink points at a jumble of tubes and lines, connected to pumps. The hoses eventually lead to a set of branched silicon blood vessels. Here, the actual measurements of fluid streams of artificial blood take place, using the so-called laser particle image velocimetry method. 'By injecting tiny fluorescent particles into the fluid stream, and visualizing these using a laser, we can capture their movements with a high-speed camera,' Groot Jebbink explains. 'From these images we can calculate and model blood flow profiles in vitro.' A disturbed blood flow is a key factor in the development of cardiovascular diseases.

## Clogged blood vessels

Vascular diseases are caused by a complex set of factors. For example, a higher blood vessel diameter may predict the chance for a rupture in case of an aneurysm. However, biological processes in the vessel wall might be even more important. Research has shown that the vascular blood flow, and related parameters as the wall shear stress (WSS), is strongly connected to the development of vascular diseases. A disturbed vascular blood flow, resulting in either too low or

too high WSS, may result in progression of the disease. Vascular surgeon Michel Reijnen explains: 'A changed WSS may disturb the alignment of the endothelium, the cells lining the inner vessel wall, resulting in a different gene expression and cell division, and an easier penetration of, for example, inflammation cells in the vascular wall. This is the first step towards vascular diseases, such as dilated or clogged blood vessels.' According to the scientists, it is crucial to couple this biological behavior of the vascular wall to visualized blood flow profiles and link these to the treatment and the subsequent development of the disease.

## Restore healthy blood flow

Patients with dilated or clogged blood vessels are often treated by placing one or more stents in the affected area. A stent is a small tube that helps restore healthy blood flow. But the location and sizing of the stent placement is crucial because, together with the patient's anatomy, it impacts the blood flow. This may result in a locally changed WSS and new vascular problems. Often, this happens at the edges of the stent. It is therefore crucial to place the stents in such a configuration that it doesn't impact the blood flow. The in vitro model may help to understand how stent placement influences the blood flow and how new vascular problems can be avoided. By placing stents of different shapes and sizes at different locations in the silicon vessels, the scientists are able to study the effect on blood flow profiles in vitro. 'We are for example experimenting with stent placement in branching silicon blood vessels,' Groot Jebbink says. 'By measuring the blood flow before and after placement, we can see the impact of the treatment in vitro.'

## Golden standard

The current in vitro model, where Groot Jebbink measures blood flows using laser particle image velocimetry, is considered the golden standard. It increases the know-how of the effect of stent placement on blood flows and the associated WSS. However, the method can't be used in real patients: a laser is simply not able to see through tissue. For a long-term prognosis of the progression of vascular diseases, and identify risk zones, monitoring and predicting the blood flow in real patients before and after treatment is essential. Therefore, the scientists are developing additional technologies, applicable in patients. Currently, they are using a method where a new echo machine creates and visualizes contrasting microbubbles in a patient's blood stream. From these microbubbles, blood flow profiles can be calculated. This technology was first tested in the aorta of healthy volunteers where after a study in patients was initiated. 'These clinical studies are very promising and the echo method is able to reveal blood flow profiles in patients, also in the presence of stents,' says Reijnen.

## Sophisticated computer model

Although the echo technology is essential to monitor blood flow and identify problem areas in blood vessels, it would be even more effective to predict the effect of stent placement on the blood flow. 'Ideally, I would like to calculate the blood flow profile and the associated WSS of the problem area before treatment,' Reijnen says. 'The impact of stent placement on blood flow profiles should be assessed before it is actually placed.' This requires the development of individual, patient-specific blood flow profile models, where the patient's anatomy and physiology are included as well. This can be achieved with a sophisticated computer model, the so-called Computational Fluid Dynamics (CFD). By combining standard clinical measurements of anatomy and physiology with blood flow profiles using the echo technology, CFD subsequently calculates the individual blood flow profiles and WSS before and after the placement of a stent. CFD analyses might also determine what kind of follow-up is needed. Reijnen applied the first version of CFD on a patient with returning vascular narrowing at the stent edges. Reijnen: 'The outcome of the CFD model showed there was a disturbed blood flow at the edges of the stent, resulting in a very low WSS, indicating a high-risk area. If we had known this beforehand, we would have chosen for the placement of an additional covered stent to reduce the impact of the disturbed blood flow.'

*'The echo method is able to reveal blood flow profiles in patients'*

## Important advances

Seven years of collaboration, where the technical know-how of the University of Twente is combined with Rijnstate's expertise on clinical/medical issues, has resulted in important advances in monitoring cardiovascular disease development and effects of treatment. And the future is promising. Improved CFD will give scientists the possibility to reliably predict the benefits of a treatment as well as the long-term prognosis. Further, the risk on future complications can be assessed and it can be decided if and what kind of follow-up studies are needed for a patient after placing a stent. But the scientists conclude there are additional benefits. 'The collaboration enables both the UT and Rijnstate to have more possibilities for clinical-scientific research and more internship positions for different study programs,' says Reijnen. 'In addition, more, better and also more fundamental research is possible. Without collaboration, there is no progress.' ●

# E! EUREKA

**The eureka moment, the moment when you have a brilliant idea or a sudden discovery. We asked UT researchers about their eureka experience.**

I work as a social psychologist. In my research, I focus on the interaction between people. That is a big difference compared to, say, mathematicians or physicists who work on theoretical problems and formulas. They are the first people to come to mind when I think about eureka moments. I am interested in the natural behaviour of different groups in extreme situations. My goal is to research those situations in as controlled a manner as possible, without any disrupting influences and in accordance with ethical guidelines. That can be quite a difficult feat to achieve. Developing a research project requires a lot of creativity. During any research, we can often only focus on a small aspect of our field. That is why I want to think carefully about what we are researching. What is the problem, really? The organisations involved often do not even know that themselves. I usually spend some time with them, ask as many questions as I can and try to gather all possible information. Only after acquiring all this input can I let it brew. An excellent way to do that is while I am working in my garden.

For me, gardening is a time to get my head straightened out. Before long, the insights I need come to me. If I do

Text: **Jelle Posthuma**
Photo: **Rikkert Harink**

# *Ellen Giebels*

**PROFESSOR OF PSYCHOLOGY OF CONFLICT AND SAFETY**

not work in my garden for a week, it really starts to affect me. I absolutely need those moments of reflection. I believe it is about stimulating associative thought processes. Those insights do not appear out of thin air. First, I have to gather all kinds of perspectives and ideas. I put myself into other people's shoes and gather the ingredients I need for my research. Only then can my garden revelations begin to stir.
During the week, I do not really have enough time for this. Luckily, I can spend my weekends in our garden. We have a large one-and-a-half-hectare garden where I can find all the peace and quiet I need.

During those moments of reflection, I write a scenario for the research. How can I study the problem at hand in a clever manner? What should I use as a theoretical framework? Are there existing scientific instruments we can use or do we have to develop something entirely new, e.g. using the latest technologies? Those are the questions I ask myself. Furthermore, the practical contributions of our research are an important aspect of my work. Once I have found the solution and know how we can set up the research, it can definitely feel like a eureka moment.

Text: **Enith Vlooswijk** Photo: **Rikkert Harink**

# *Wanted:* a new way of looking at ourselves

**Are we the sum of our cells, or are we changing creatures who constantly assign new meanings to ourselves? What role does modern technology play in this matter? With a Doctoral Grant for Teachers, Bart van Haaster, philosopher and lecturer at Saxion University of Applied Sciences, will explore these issues over the coming years as a UT researcher.**

Be honest: how often do you check your Facebook, Instagram or other social media to see how many likes you got? What songs does Spotify recommend to you? What advertisements draw your attention on screen? How does all that affect the way you look at yourself? That last question is particularly difficult to answer, because how do you define 'yourself'?

The research that philosopher Bart van Haaster is currently setting up is dedicated to gaining a better understanding of such questions; not just because it benefits users personally, but also because it gives developers of modern technologies more insight into the possible effects of their design.

Van Haaster knows what can happen when new technologies are haphazardly placed into users' hands. Take the healthcare robot, for example, or other e-health applications that were designed to increase patients' self-sufficiency. When it turns out that users start to feel dependent on the technology, the question remains whether their self-sufficiency has truly been improved. 'What I see in practice is that such concepts are hard to get a grip on,' Van Haaster explains. 'What is self-sufficiency, exactly? Shouldn't we involve such questions much earlier in the design process, before releasing a new piece of technology into the social domain?'

*'We believe we have an authentic, fixed "self", which we fear can be lost'*

## Materialistic worldview

Van Haaster's research is dedicated to getting the developers of modern technological innovations to think about a number of basic concepts – such as autonomy, identity, self-experience, etc. – at an early stage during the design process. The way in which we look at such issues is not always in line with today's reality, the philosopher believes. In fact, the common perspective in our society is based on a rather materialistic and scientific worldview: we try to reduce everything around us to tangible elements. 'We frame ourselves and the world around us as things, objects, collections of molecules with static, unchangeable cores. We believe we have an authentic, fixed "self", which we fear can be lost.'

Van Haaster believes our view on technology also tends to be quite straightforward: we see technological innovations as instruments that can be used to achieve a goal. In reality, technology affects our worldview and our way of life. Think of the jogging app on your smartphone, for example. It not

only counts every step you take, but also inspires you to change up your exercise routine.

## Reinvented through technology

This materialistic worldview and that straightforward view on technology do not go well with the experiences that modern digital technologies create, Van Haaster believes. These technologies challenge us to constantly change ourselves or the idea we have of ourselves. The categories that you are shown with regards to yourself, even in the form of something as simple as emojis, partly determine how you view yourself,' the philosopher says. For example, an avatar is not only the image we use to represent ourselves during a Twitter discussion with another person; it actually becomes part of our very identity.

To better account for the possible effects of new technologies on their users, Van Haaster is researching whether we should instead view people as changeable creatures that can assign meaning to themselves and others. This idea might not seem all that revolutionary, but it can have a major impact on the way in which we view the impact of technology.

'At the moment, we are running aground in terms of the way we think about ourselves,' Van Haaster explains. 'Much of our thinking is based around the idea of manipulability. Objects can be made, changed, made bigger or smaller, smarter or dumber. There is a connection between this thinking and object thinking. With a different conceptualisation of the self, such as the one I will use, we may learn that we are not as much in control as we like to think and that it is not so strange to reinvent ourselves through our interaction with technology.'

## DesignLab

Van Haaster will not be conducting his research in isolation. One of the key characteristics of the Faculty of Behavioural, Management and Social Sciences is that its researchers regularly share their philosophical insights with colleagues from other fields. This is done in DesignLab, a place where researchers from a wide range of fields come together to study the relationship between society and technology.

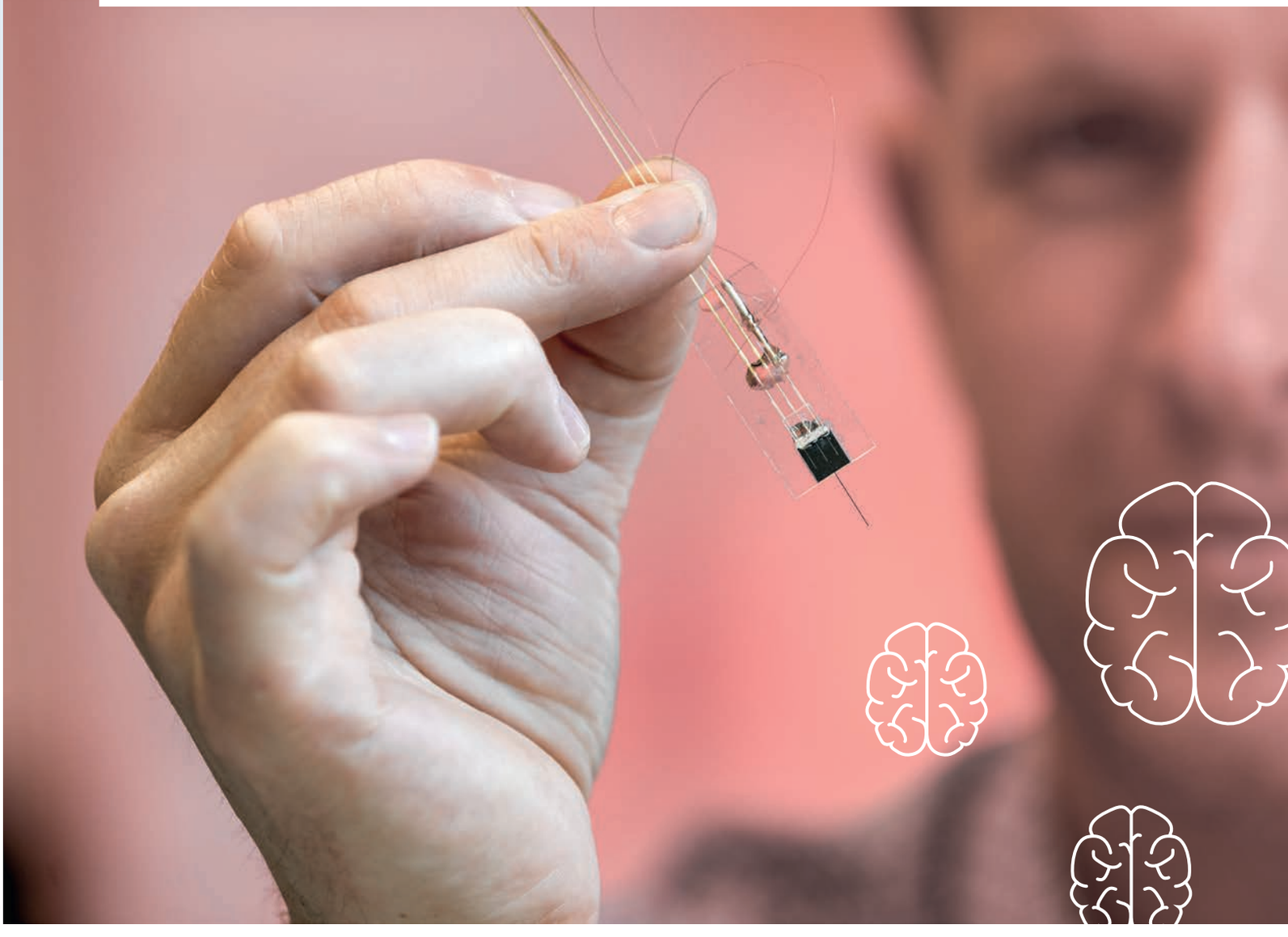
Peter Paul Verbeek, Van Haaster's thesis supervisor, has extensive experience with this. 'In the scientific world, the divide between the hard and soft sciences is still quite large,' Verbeek says. 'The major challenge of DesignLab is that it gets people to bridge this gap and discover the benefits of doing so. The reason this approach is so successful here is because we have a physical place that is designed to accommodate all phases of the design process.'

Van Haaster's research is still in its infancy. Over the course of the next four years, it will become clear what new insights about modern technology and self-reflection come out of DesignLab. ●

MATHIEU ODIJK AND HIS PERSONAL MOTIVATION

# Uncovering the brain's migraine secret

**What happens inside the brain of a person suffering from a migraine? That is the puzzle that UT researcher Mathieu Odijk is trying to solve together with researchers from the LUMC in Leiden. Besides his scientific interest, he has a personal stake in this research: Odijk's sister had severe migraines at least twice a month and he experiences it around twice per year as well.**



Text:
**Frederike Krommendijk**
Photos:
**Rikkert Harink**

*'During a migraine episode, the entire brain goes crazy'*

'Migraine is a common condition found in twenty-five percent of women and circa twelve percent of men. Although we are nowhere near finding a cure, neurologists can treat the condition better when we understand how the episodes occur,' Odijk explains. He is part of the BIOS Lab-On-Chip group and is in charge of the 'Micro- and nanodevices for Chemical Analysis' theme. He ended up working on the migraine research via his fellow scientist Albert van den Berg, who won the Spinoza award in 2009. 'Albert got to talking about migraine with two other winners that year: Michel Ferrari, famous migraine specialist, and Marten Scheffer, who is conducting research into tipping points in complex systems.'

## Avalanche

Researching those tipping points that make the brain go haywire requires far more accurate tools than what is currently available in medical science. 'During a migraine episode, the entire brain goes crazy. A small disruption creates a snowball effect and in some cases even an avalanche. People who suffer from such severe episodes that they see an aura around everything and even experience flashes of light are probably undergoing a wave of depolarisation throughout their entire brain. Even after the episode is over, its effects are felt for days, because the neurons struggle to recover. We have not yet found an answer to the question of why the system is disrupted so severely.'

One thing that is clear, however, is that hormone changes can trigger a migraine ('Since having her first baby, my sister's migraine episodes have become far less frequent.'), just like stress and an irregular sleeping pattern. 'However, our current tools are not accurate enough to tell us exactly what happens during a migraine attack and how that extremely complex biochemical interplay between ions, neurons and neurotransmitters is disrupted exactly. Although you can make MRI and CT scans, those only show activity from the outside. What we really want is to know how the chemicals inside the brain function without this requiring an invasive procedure.'

## A look inside the brain

In order to take a closer look at the brain's chemical processes without any dangerous procedures, Odijk and his research group, which collaborates with the University Medical Centre in Leiden, developed a needle that is designed to extract neurotransmitters and electrical signals in the brain. These neurotransmitters are the brain's chemical messengers. The needle is as thick as a human hair and contains three miniscule channels with apertures the size of a bacteria, making them invisible to the naked eye. 'With this needle, you can very carefully suck up neurotransmitters and other molecules found in cerebral fluid, without taking out any cellular matter or pieces of cells.'

Once they did that, they had to overcome a new challenge. 'You can imagine that, after being extracted, the fluids are no longer in the same order that they were in inside the brain. They are jumbled, as it were. Simply put, we have developed a method that uses miniscule quantities of oil to separate the fluids inside the needle. Using enzymes that turn the neurotransmitters into hydrogen peroxide, we can make the neurotransmitters visible with a fluorescent liquid.'

## The long run

We should not expect spectacular result any time soon. For now, Odijk and his partners of the University Medical Centre in Leiden are simply excited about having a research system that works properly. Once they achieved that, it could be tested on mice. 'Of

course, that does not tell you all you need to know. A mouse's brain is very different from a human brain. In mice, the migraines are triggered instead of occurring spontaneously. There is a lot we still have to improve about our research to make it scientifically valuable. We do not know a lot about how an episode is triggered. However, we have taken the first step towards the development of a useable research tool. Science is all about the long run.'

Odijk has not lost any of his motivation, though, if only because migraines are so common: a quarter of all women between the ages of 25 and 45 have them, as do twelve percent of the men in that age group. 'The direct medical costs and their absence at work result in half a billion to one billion euros in damage every year, which does not even take into account the effects migraine has on the patients themselves.'

## Other conditions

Odijk expects his biochemical brain research to ultimately benefit the research into other neurological diseases as well. 'We are entirely focused on migraines at the moment, but you can image that a tool this accurate can also be used to study what happens inside the brain of people with Alzheimer's or Parkinson's, for example.'

Odijk expects the major breakthrough to occur when the biological reality can be simulated with an organ on a chip, grown from human stem cells. 'A brain-on-a-chip would allow us to gather information in a far more accurate manner. It might not replace the use of mice entirely, but it would certainly complement it. However, all that is still in its infancy at the moment.' ●

*'Science is all about the long run'*

# Cheating

Once again, a theory about the moral disposition of our species can be thrown out. Although it did not make the front page, the American experimental philosopher Thomas Nadelhoffer rightfully dedicated a series of tweets to the issue not too long ago: the eleven-year-old cheating theory has been debunked. This theory, developed by Kathleen Voks and Jonathan Schooler, was published in the journal Psychological Science in 2008 under the title: The value of believing in free will. Encouraging a belief in determinism increases cheating.

The theory boils down to this: under the influence of deterministic beliefs, people are less conscientious. Put simpler: those who believe that a person is at the mercy of a wide range of genetic and social factors are more likely to cheat and blame everything on their genes or the rest of the world. However, those who believe in free will are less likely to give in to immoral impulses.

The researchers backed up their idea with two experiments. A few dozen students were asked to complete a series of assignments, but they were enticed to cheat while doing so. The subjects who had read texts with a deterministic subject matter prior to the experiment were more likely to give in to that temptation than their colleagues who had read about free will or neutral subjects. According to the authors, this result raised some important questions: if deterministic beliefs turn people into spineless opportunists, should we not protect them against those ideas? Luckily, things are not as bad as they might seem. In three different studies, for which the experiments were repeated a total of eight times, no effects were found at all. Bye, bye, cheating theory.

In recent years, other theories about (un)ethical human behaviour were also debunked. The Stanford prison experiment, in which ordinary students turned into sadistic tormentors in their role as prison guards, turns out to have gone quite differently from what researcher Philip Zimbardo claimed at the time. Stanley Milgram's classic experiment – people obey without complaint when the research leader orders them to electrocute another test subject –produced different results upon being repeated. More recently, security cameras put an end to the famous 'bystander effect.' This theory, which claims that people in a crowd are less likely to come to someone's aid because they feel others should do so instead, is simply not compatible with what is seen every day in real life.

In short, it seems our moral compass is not fooled quite as easily as these classic psychological studies would have us believe. I would say that is good news for us hairless apes.

***Enith Vlooswijk***

***Science journalist***

SRIRANG MANOHAR WORKS ON A NEW BREAST CANCER IMAGING MACHINE

# Excitement to solve clinical problems

**After a careless childhood and strict education, the lab is where UT Professor of Multi-Modality Medical Imaging Srirang Manohar (49) found the right chemistry and fell in love with science. It sparked the choice for a Master-PhD degree in the hustle and bustle of the Indian megacity of Bangalore. Which brought him to the relative serenity of Twente, where he is now working on a 'beyond state-of-the-art' breast cancer diagnosis machine.**

At the time of the interview, Professor Srirang Manohar is up to his neck in cardboard boxes, while still in his office in the Zuidhorst. After excusing himself for the supposed mess, he shares his excitement of moving to the 'truly astonishing' Technohal. Manohar is moving from the Biomedical Photonic Imaging group to take up the position of Chair and Full Professor of a new research group: Multi-Modality Medical Imaging – or M3i in short. 'Our main goal is to use the talent of this university to solve clinical problems in hospitals. The more short-term goal is to get this new group to flourish. I believe we have a unique mix of critical ingredients: medical technology, the TechMed Centre and top-class clinical Professors like Bob Geelkerken and Michel Reijnen.'

## Growing up

Srirang Manohar grew up in the Indian city of Bangalore. 'Which is massive by European standards, with a population of about 8 million people nowadays. I had the good fortune of being born in a middle-class family. My mother was an artist, my father worked at a research institute. They left me in peace to find out what I wanted, and I can honestly say my childhood was the happiest period of my life. You could bike anywhere and play where you wanted. I felt totally safe and carefree.'

Manohar went to an all-boys Catholic middle school in Bangalore. 'Very tough, very disciplined,' he says. 'With children from all corners of society. We wore uniforms to balance things out between rich and poor. I wouldn't call it an elite school, but most of the students ended up being very successful. One of them invented Hotmail, another one became captain of the national cricket team.' After eight years, it was time for pre-university. 'The first time we went to class together with girls.' Jokingly adding: 'At this point we realised they also existed.' At university – still in Bangalore – he studied power engineering. 'Which was thought to be very important to the country. But after my bachelor, I felt completely lost. Most people should know what they want by then, I didn't. Luckily, my father was working at one of the top universities and I ended up as a project assistant for PhD students in the field of material sciences. There, in the lab researching the thermal properties of matter, I fell in love with science.'

## Love story

Starting a PhD one year later at the Indian Institute of Science is part of his ongoing scientific love story. Which sparked another love story and his eventual move to Enschede. 'During my PhD, I had the opportunity to organise an international conference. I searched online for more groups in the same research field to participate– on AltaVista, since Google didn't even exist back then. The

Text: **Rense Kuipers**
Photos: **Rikkert Harink**

# SRIRANG MANOHAR

first hit: a group at the University of Twente. I sent an email to their secretary. Later on, we stayed in touch: she visited my university in India, I visited her in the Netherlands. Soon, it became a bit more than that between us. Right now, you ask? We're very happily married,' Manohar says, adding: 'Something quite enigmatic: the night before my job interview for a postdoc position in photoacoustics at the UT, she dreamt that I helped her mother who, sadly enough, had passed away years earlier because of breast cancer.'

## Dream machine

Nowadays, Manohar is the project leader of a multi-million European project called PAMMOTH. 'We're working on a breast cancer imaging machine that is going to be beyond state-of-the-art,' he says determined. If all pieces fall in their place, the consortium the professor is leading will have a machine ready that combines ultrasound and photoacoustics, and can give quicker and better results than the current mammography technology. 'Breast imaging nowadays is well established: by using x-ray mammography, ultrasound and MRI technology – often all three – a physician can get enough information to decide which further steps to take. But there are several major flaws. The x-ray procedure is painful and ionizing radiation is used. Especially before menopause, it's hard to distinguish a tumour from glandular tissue. With ultrasound, it's also not easy to spot the difference between a benign or malignant tumour. An MRI is highly expensive, and the patient has to lie completely still for a long time.'

By combining and building on existing photoacoustic and ultrasound techniques, the PAMMOTH machine can solve multiple problems at once, according to Manohar. A woman lies face down in the machine, with her breasts in a bowl-like construction. Within five minutes she is scanned, after which the machine can give the physician the proper information. 'This diagnostic method is painless, radiation-free and most important of all as real-time as it gets. This saves patients weeks of waiting in fear for results.'

This machine is a potential lifesaver, considering the sad statistics: over 2 million women were diagnosed with breast cancer in 2018 worldwide and 500 thousand lost their lives to the disease, according to the World Cancer Research Fund. Manohar is quick to put things into perspective. 'In principle, this device could replace the current diagnostic procedures. There is a lot of hard work put into this project by all involved partners. Now, all of the components have come together at the UT and are being assembled. Later this month, the first machine should be in a hospital. We have to show that all the functionalities work the way they should, which should make

## Srirang Manohar in a nutshell:

| | |
|---|---|
| 1992 | Graduated from RV College of Engineering |
| 2001 | Obtained a combined MSc-PhD at the Indian Institute of Science and moved to the UT |
| 2004 | Veni laureate |
| 2017-now | Leading the Horizon2020 project PAMMOTH, while at the Biomedical Photonic Imaging group |
| 2019-now | Full Professor and Chair Multi-Modality Medical Imaging |

it clear if this machine has a right to exist. If so, the results should lead to large clinical studies, which will help us find out if this is an effective method.'

### Dutch behaviour

Besides diagnosing breast cancer, the Multi-Modality Medical Imaging professor is also working on projects aimed at imaging from the inside out. For instance in the case of hydrocephalus (also known as water on the brain). Together with Indian researchers, he is developing a needle-scope that is packed with optic fibres and ultrasound sensors, which can help surgeons do the procedure more accurately. 'Especially in rural areas, surgeons usually don't have good navigation tools. So they have to do it blindly: making a hole in the skull and placing a shunt. If you have a navigation tool on the inside, you gain a lot more information about the position of the ventricles.' While looking into this topic, Manohar worked together with a bachelor's student. 'She showed the most typical Dutch behaviour, by simply writing an email to a surgeon at MST who is an expert on hydrocephalus. Personally, I thought that was too cheeky of her. But we were invited to come over and witness a surgery. Dutch people are very forward, which has its upsides. After living here for more than eighteen years, I thought I was used to it. It's also a crazy example of how good the local hospitals – MST and ZGT – are to us.'

Manohar lives in Haaksbergen, together with his wife and their three dogs. They have a Barzoi, a Saluki and – their latest addition – a Scottish deerhound. 'That thing was a giant puppy, with zero clue about its own size and surroundings. Luckily, we have a huge backyard, where the dogs love to run around.' Cooking, especially Indian food, is a passion of his and his wife. Creativity is another outlet. As the son of an artist, the apple didn't fall far from the tree. Which is clearly apparent when he shows a few sketches of his dogs, next to his computer. 'My mother never pushed me, but I have started sketching recently. She says I'm talented, I don't know if that's really the case but drawing helps me to observe things better.' He has also been an avid photographer, where observing and timing is of importance too. But if Manohar wouldn't have become a scientist, maybe he would have been a writer by now. 'In the old days, I used to write on and off for a local newspaper. Maybe there would have been a career in it. I used to write a lot together with an old friend of mine, who ended up becoming an author of children's books. It does help me when I'm writing research articles, though.'

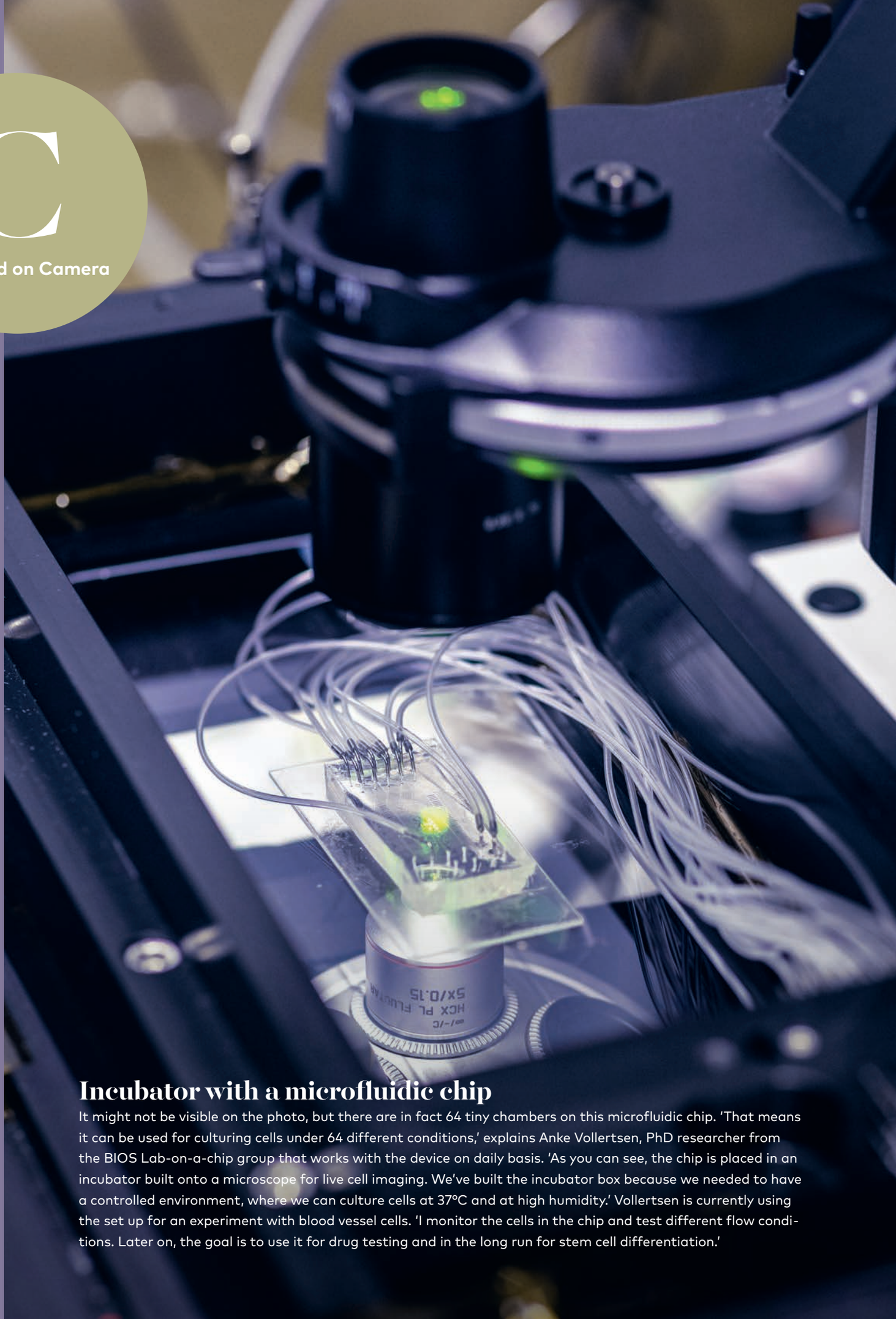
### Excitement

Excitement is what makes Srirang Manohar tick. Be it in the little things, like coming to work every day or having a bachelor student write emails to a surgeon. Or in the bigger things, like seeing the dreams and ambitions in a big project like PAMMOTH coming together. Because to Manohar, excitement is a catalyst for making things happen. 'Things that matter, that directly help people. I don't know what I would do if it wasn't something that was applicable for the benefit of people.'

*'In the lab, I fell in love with science'*

C

Captured on Camera



Text :
**Michaela Nesvarova**
Photo :
**Rikkert Harink**

## Incubator with a microfluidic chip

It might not be visible on the photo, but there are in fact 64 tiny chambers on this microfluidic chip. 'That means it can be used for culturing cells under 64 different conditions,' explains Anke Vollertsen, PhD researcher from the BIOS Lab-on-a-chip group that works with the device on daily basis. 'As you can see, the chip is placed in an incubator built onto a microscope for live cell imaging. We've built the incubator box because we needed to have a controlled environment, where we can culture cells at 37°C and at high humidity.' Vollertsen is currently using the set up for an experiment with blood vessel cells. 'I monitor the cells in the chip and test different flow conditions. Later on, the goal is to use it for drug testing and in the long run for stem cell differentiation.'

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