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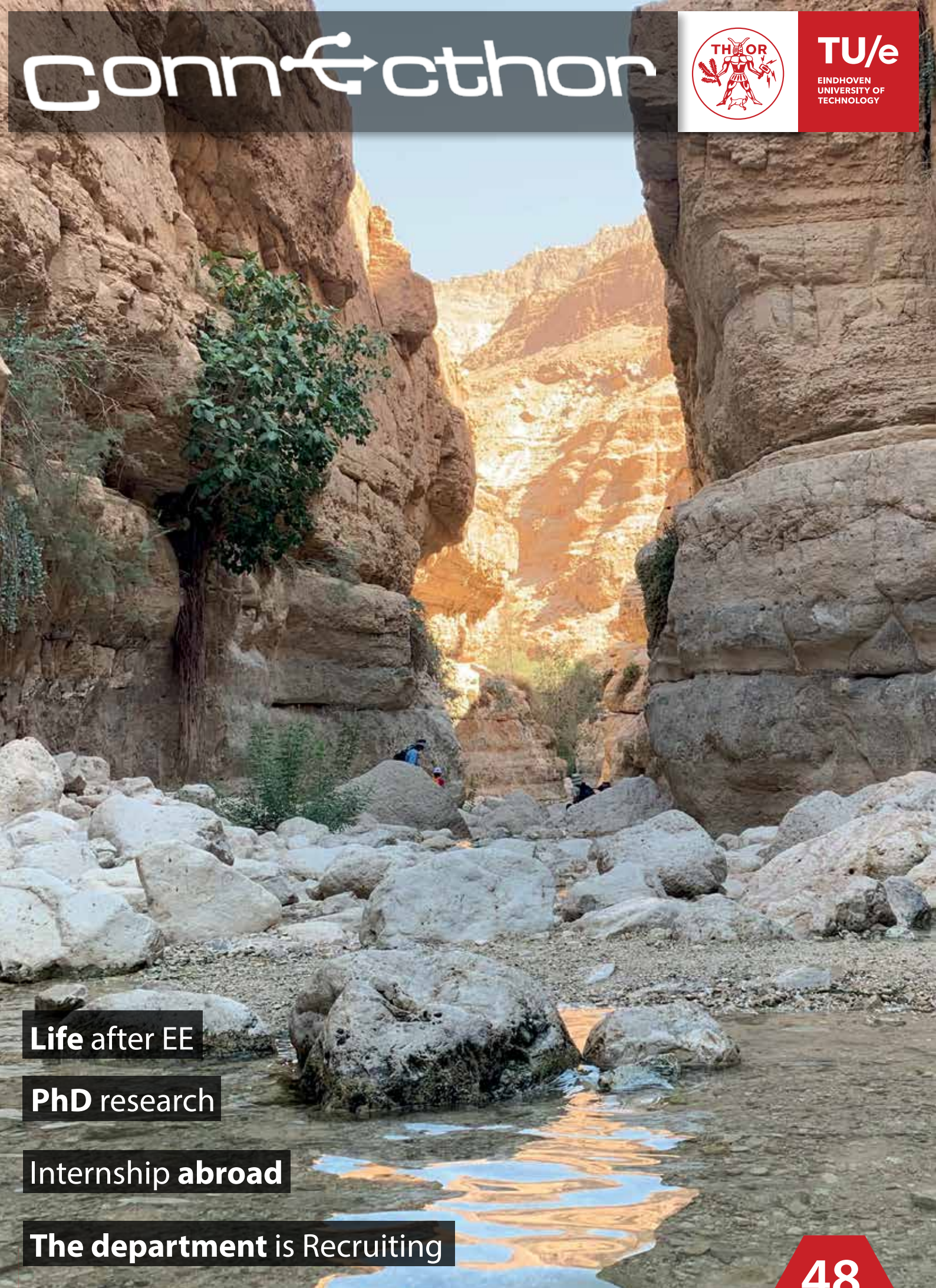
TU/e
EINDHOVEN UNIVERSITY OF TECHNOLOGY



Life after EE

PhD research

Internship **abroad**

The department is Recruiting

48
December 2019

Magazine of e.t.s.v. Thor and the department of Electrical Engineering at Eindhoven University of Technology

Connecthor
Volume 12, issue 4 - December 2019

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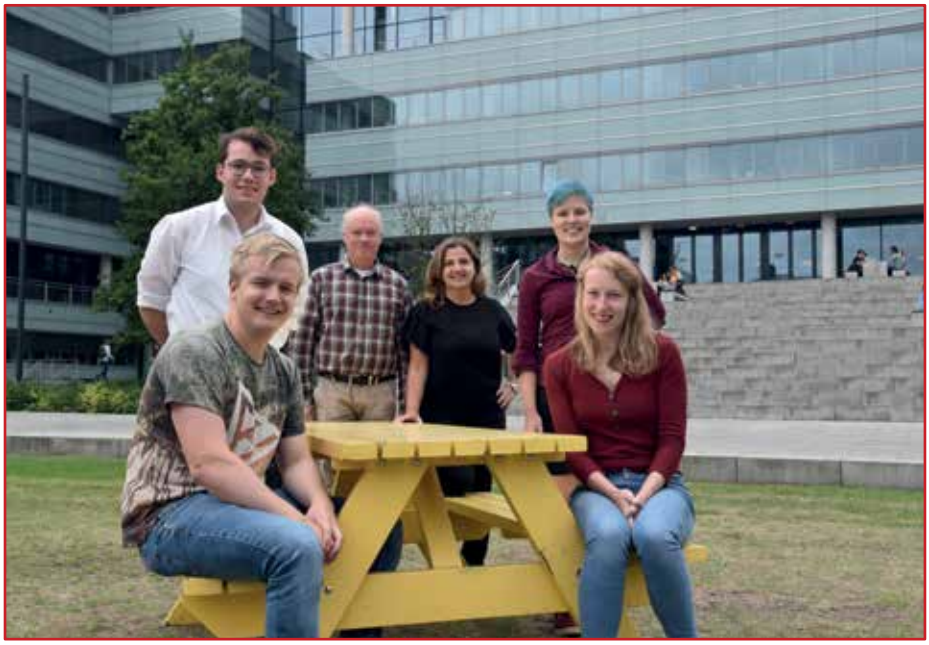


With the end of this calendar year in sight, we present to you the new December issue of the Connecthor magazine.

You might have heard of it through the grapevine, Ton Backx has stepped down as the leader of the Institute for Photonic Integration, due to his upcoming retirement. As of September 1, 2019, Andrea Fiore has taken over that position. Read more about it on page 12.

Ronis Maximidis from the Electromagnetics group writes about MaxWaves' mission to bring high data rate gigabit connectivity around the world. Read more about this new spin-off initiative on page 26 and 27.

This time we do not have one, but two Internship Abroad stories to share with you. Kyle van Oosterhout had the experience of a lifetime at the Utah Electrode Array in Salt Lake City, USA and Mark Legters writes about his unforgettable time at the Weizman Institute of Science in Rehovot, Israel. On the cover you will find a photo of the Wadi Arugot, En Gedi Nature Reserve in Israel, taken by Mark on one of his hikes.

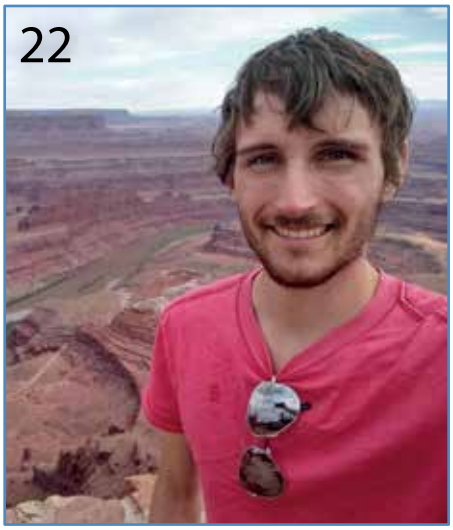
Alumnus Giel op 't Veld writes about his life thus far after graduating in 2012.

The study association Thor has organized a few events that are captured in this magazine, such as the 1957 Party, a party organized with the four TU/e associations founded in 1957.

We hope you have enjoyed the year's end party on Monday December 9, 2019 offered to you by the Department Board. Photos of this event will be shared with you in the March issue.

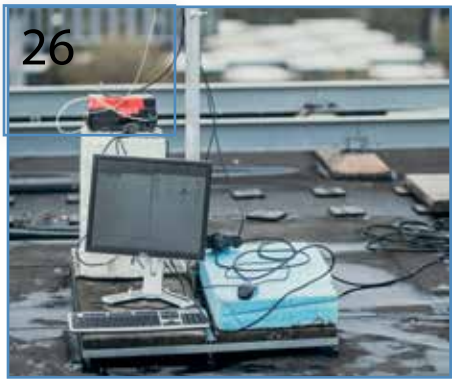
We wish you a lovely Holiday Season, a very Merry Christmas and a wonderful and joyful New Year!

The Connecthor editorial board ■



Internship Abroad
Still wondering where to go for your intership? You can find a good example on page 10 and 22

Life after EE
Read more about Giel op 't veld his life after graduating on page 20



MaxWaves
Read more about MaxWaves on page 26

Icons of EE
Read more about the life of Elon Musk on page 14

Research strategy and investments

By: Bart Smolders

In the past year a lot of effort has been put in defining the strategy of our Electrical Engineering department for the upcoming decade. The national sector plan process appeared to be an excellent framework to align with our partner departments from Delft and Twente, and to align internally on a common strategy for our department. Based on this, we made several strategic choices regarding investments and research focus. This outcome is summarized in Figure 1, where the national "sector-beeld" is shown, and our strategic choices at TU/e.

The three focus areas are discussed in more detail below.

Focus area 1: Signal processing and imaging

In the area of signal processing, the orientation towards society has led to strong positions in several currently disjoint areas. In the medical field, the Eindhoven research is strong in patient monitoring and image analysis (including data engineering and artificial intelligence) to support medical diagnosis and the trend towards personalized healthcare. In communication-related signal processing, there is a strength related to wireless (e.g. 5G/6G) and optical communication. Both strengths are examples of a more general tendency to develop systems with large numbers of sensors: as sensing is becoming cheaper, new technical opportunities arise quickly, which depend on fast, often real-time, signal processing and imaging. There is a strong potential for cross-fertilization across these historically distinct expertise domains.

Focus area 2: Communication

The focus area 'Communication' covers our research in the transport, networking and processing of information. It notably addresses the booming needs in our increasingly networked society. Although radio-waves and light are both electromagnetic waves, wireless technology traditionally uses the radio spectrum up to 10-100 GHz, and optical communication uses infrared or visible light carried in glass fibers, with frequencies above 100 THz. At TU/e, the optical research has produced world-leading developments in optical signal processing chips (integrated photonics) in the Indium-Phosphide (InP) platform as well as powerful optical system and network platforms. Simultaneously, radio-spectrum technology is aggressively expanding into the mm-wave and THz regions for communication (5G and beyond) and sensing. Current demands for higher bandwidths, lower latency, larger networking flexibility and a smaller energy footprint can effectively be met by merging these technologies.

Efforts are already being made to connect the wireless and optical research domains. But to exploit our expertise and initiate globally relevant developments, we need a structural investment in basic research that stimulates this convergence.

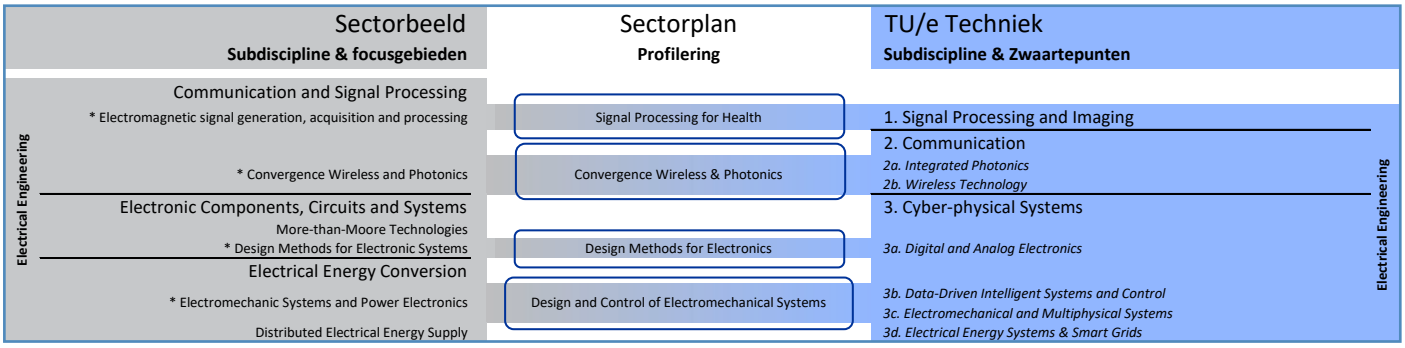


Figure 1: National focus areas of Electrical Engineering (left column) and our focus areas (right column)

Focus area 3: Cyber-Physical Systems

Man creates complex systems, some of them being machines such as chip-producing wafer-steppers, others rather being systems of systems, such as the internet or the electricity grid. These so-called cyber-physical systems are systems of high complexity in which tightly interwoven software and hardware is directly interacting with physical processes and creates functionality which is significantly more than the sum of its parts. The research in cyber-physical systems covers a couple of closely related topics of the Electrical Engineering discipline: control and systems theory, the hardware and software for computing, and the digital and analog electronics which make this possible. All these aspects come together in the areas of high-tech equipment, electromechanical actuation, (wireless) sensing, (wireless) energy and information transfer, electrical energy supply and grids, and more.

The fundamental research in these focus areas is performed in our nine capacity groups supported by our three centers that are aligned with the three focus areas. Within each capacity group, several independent "labs" have already been defined in line with TU/e policy. We have agreed with our capacity groups that all the labs need to be defined by the end of 2019. In the upcoming years we will use the additional budget to extend our scientific staff (we will have more than 20 UD/UHD/HGL vacancies in 2019-2020) and to further invest in our unique labs. Next to this, we continue our efforts to improve the "dekkingsgraad" in order to stimulate our scientific staff to focus more on fundamental research at low TRL levels.

Please contact me personally if you have a question or suggestion related to this topic. ■

Bart Smolders, a.b.smolders@tue.nl

Bachelor graduates

Automotive Technology

Aron Aertssen, David van Blijderveen, Tom van den Bosch, Jokūbas Čiurlionis, Gijs Cunnen, Arda Dağkılıç, Sjors van Dijk, Koen Draak, Julien Duclos, Matej Ďurajka, Horst Fietje, Dylan Frijters, Noud van de Gevel, Niels Goorden, Luuk Heijmans, Lars Hendrix, Yannick Heuts, Guus van den Heuvel, Daniël van Hoek, Michiel de Hoop, Jorn van Kampen, Bram Kersten, Jarl Lemmens, Sjoerd Mennen, Lorenzo Orsini, Tim Schoonbeek, Nick Smit, James Sutton, Kjeld Teunissen, Mario Tilocca, Jonathan Verhaar, Jelle Versluis, Stefano Vojinović

Electrical Engineering

Sjoerd Aker, Thomas Bastiaansen, Jim Beckers, Niek Blankers, Femke de Bot, Willem Broekman, Carlo Caracciolo, Youri Coenen, Daan Daverveld, Leroy Driessen, Harm van den Dungen, Shreya Dwivedi, Filip Forro, Esmé Galesloot, Thijs van Gansewinkel, Robin van Geel, Joep Gevaert, Giovanni Ghezzi, Martijn de Haas, Joost Hakvoort, Elwin Hameleers, Micha van den Herik, Joni Hermans, Thijs Jan van Hoek, Bodhi Hopman, Ricardo van Hout, Gerben Hup, Jorick Jans, Ivar Jansen, Marjolijn Kleijer, Koen Kusters, Emilija Lazdanaité, Dorus Lemmers, Thomas Lippens, Quirijn van der Mark, Diederik Markus, Raoul Melaet, Maarten Molendijk, Patrick van Mourik, Gijs Neerhof, Nadine Nijssen, Nehir Onat, Lotte Paulissen, Quinty Peters, Fer Radstake, Thomas Reep, Stijn Ringeling, Ivo Rooijackers, Nick van Rooijen, Nitya Saraswati, Vincent van de Schaft, Remco Schalk, Alessandro Sona, Tristan Stevens, Birgit van der Stigchel, Mariska van der Struijk, Jaan Suzik, Michalina Tataj, Mark Tiemersma, Niels Valckx, Coen van de Ven, Flin Verdaasdonk, Marc Visser, Michiel Visser, Lars van der Vossen, Ivar de Vries, Rick Weenink, Thomas van der Werff, Mikolaj Wolny, Joey Wouters

Master Graduates October 8

Aiman Setiawan
Sjoerd Doumen
Aditya Halim
Egia Kamandika
Tim Slangen
Mitchel Vorstedt
Wing-Tsi Wong
Siyu Zhang

Willem Boerman
Koen Damen
Rik van Esch
Jigme Gurung
Matthijs Kleijer
Shijing Pu
Jasper Sleumer
Raymond Wonink
Congyi Wu
Mengzhu Xu

Steven Beumer
Rick Budé
Roel Budé
Yihan Gao
Indy van den Heuvel
Menno van den Hout
Kamrun Nahar Iti
Leon Lepoutre
Ralph Roetman
Bas van de Ven
Meerten Versluis
Shaoxiong Xie
Liang Zhang

From the President

By: Sanne van den Aker

Around a year ago I started spell-checking my first articles for the Connecthor. One of the articles was the 'From the President' part from Dana. Back then I would have never thought that I would be writing a similar piece a year later. I only just started my second year after all. However at that point I did already know I would be involved with Thor for the upcoming years, as I really felt like I had found the place to develop and enjoy myself.

And here we are, a year later I am still very much involved in Thor. I joined some more committees, met new people and found new ways to develop and enjoy myself, like becoming the President of Thor! And of course I still check articles for the Connecthor. Only a little while ago I checked Dana's final "From the President" contribution, in which she tasked the future Presidents to not write standard pieces for the Connecthor, something I feel like I might already be screwing up a little when rereading my first few sentences.

But even though it is cliché, after only two months I can see the first-year students finding their place here. Every Thursday I see them coming back to Het Walhalla and often they join us on a fun night out to Stratumseind. A lot of them joined Ivaldi, so they are well on their way to become our new load of active members.

At the same time I see a lot of familiar faces every day of which quite some are second-year students, starting new committees and learning new skills. The most awesome thing to see however is that all these different members from different generations form combined groups of friends.

With a new year there also come a lot of new challenges, the things that make life fun. For first-year students, Computation 1 is most likely one of these challenges, but another one is also settling in a new place. Luckily, Thor is there to help them with both. The first exam trainings are coming up and the freshmen weekend, where you get to know your peers a little better, has already taken place. Just like a ton of other fun activities, where you can forget about studying for a bit and make new friends. But not only our new members face challenges, we as a Board do as well. Of course there are a lot of things you can prepare for, but still a lot of random things will happen, and finding your way to do things takes a while. Nevertheless we are getting there and almost all of us made it to a party on Stratumseind after our constitution drink – one of our first challenges as a Board – so I think we are determined enough to make it through the year.

At the beginning of the year, there is still a lot to learn and a lot of challenges to take on. It might be scary or intimidating from time to time and you'll get nervous, but that is totally fine, as it will make you feel way better when you overcome this. If I did not face the things that make me nervous head on, I would have never given a speech for a room full of bachelor graduates or climbed on stage to do our famous introduction week dance during the MomenTUm party. And looking back on it, those are things I definitely would not have wanted to miss out on.

Veel gedonder!

Sanne van den Aker
President of e.t.s.v. Thor ■

Introducing...

Hi! My name is Anne Kwak, and in September 2019 I joined the Photonic Integration (PhI) group as a knowledge valorization officer at the department of Electrical Engineering. I've always found universities inspiring places: this is where all the exciting new stuff is discovered and developed! Therefore, I'm very happy to be a part of this environment now.

After finishing a BSc and MSc in Ecology, I worked on a PhD in that field. During my PhD, I spent a lot of time and effort on explaining my research to laymen and showing them why it was important work. I loved this so much that after two years I decided to quit my PhD and do an MSc in Science Communication at the University of Technology in Delft.

I love explaining research to different types of audiences and showing them why the work is important and what it could mean for people's daily lifes. And this is exactly what I'll focus on at PhI. I'll be working on a holistic communication strategy that covers all our initiatives and projects, to show outsiders what photonic integration can do for them.

In my spare time, I love to go climbing and bouldering, reading a good book (love fantasy novels!) or spending time outside enjoying nature. ■

Greetings! I am Asterios Souftas and recently I started my PDEng designer program in collaboration with the ECO group and the aviation company Fokker.

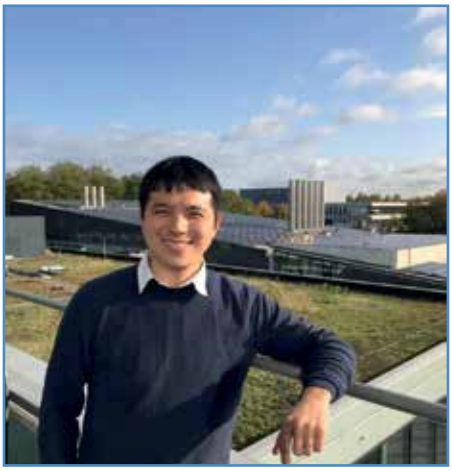
Specifically, I am tasked with designing modern aircrafts' intra-communication systems. I will be looking at ways that wiring can be replaced, and investigating possible alternatives. The flexibility of this program means that my work will have a practical application while I also get to do academic research. For me, this is of vital importance. During my Master Studies at NTUA (National Technical University of Athens) and my short internship at EETT (The Greek Telecommunications regulator) I developed appreciation on the non-technical aspects of science. Technology, and especially communications, have multiple sides: entrepreneurial, political and social are typical examples. For me that's the essence of my Designer Program: I have to take into account multiple factors in order for my work to have a real impact on the environmental cost of travelling and the flexibility of aircraft design.

Naturally, my research interests follow a similar pattern. I am interested in wireless technologies, especially in its vehicle applications (Wireless Sensor Networks, V2X Communications, Vehicle Intra Communications, Mobile Ad Hoc Networks). I also enjoy studying multidisciplinary problems of our society (Social Networks, Game Theory, Transportation Networks) and new disruptive technologies like Data Analytics and Wireless Optical Communications. ■

Hello everyone! My name is Dongsheng Yang and I have worked as an Assistant Professor in Electrical Energy System (EES) Group since September 2019, aiming at the medium-voltage power electronics technologies.

I come from the Jiangsu Province, at the east coast of China, where I obtained my bachelor, master and PhD degrees at Nanjing University of Aeronautics and Astronautics. After graduation, I went to Aalborg University in Denmark as a post-doc and then assistant professor. My research interests focus on how to use advanced power electronics technologies to safely accommodate the high penetrations of renewable energy sources as well as energy-efficient end-uses into the electrical power grids. I have a great passion to address the real-world challenges for the green energy transitions through high-quality research and education. During my spare time, I like to do sports and travel with my friends and family.

I look forward to meeting more friends at the TU/e! ■



Welcome all new colleagues!

Hi, I am Jeroen van Oorschot and I started my PhD this September. I'm working in the EES group in the pulsed power section. In the coming years I will design and build a new high voltage pulse generator for the generation of fast high-voltage pulses for water treatment. It will be comparable to a (small) lightning strike hitting a lake. Water treated with these pulses is called plasma-activated water and this water can be used for many purposes, including disinfection and plant fertilization. In this project I will work together with other PhD students for knowledge on plasma science.

I was born and raised in Lewedorp (a small village near Goes). In 2012 I started studying Electrical Engineering at TU Eindhoven. After a board year and several committees (including the Connecthor editorial board) at the study association Thor, I got interested in high-power engineering. With DSD Waldur I visited lots of companies in this field and now I'm looking forward to working at EES. ■

Hello all, my name is Wenjing Tian. I am a new PhD student in the Photonics integration group in the Department of Electrical Engineering, where my PhD adventure started in August 2019.

I was born in Hebei, China, in 1994 and grew up in Beijing, China. I received my Bachelor's degree in Applied Physics in 2016 from Beijing University of Posts and Telecommunications (BUPT), China, after which I studied in State Key Laboratory for Integrated Optoelectronics in the Institute of Semiconductors, Chinese Academy of Sciences (CAS) and received a Master's degree in 2019.

My hobbies and interests are photography, reading, traveling and visiting all kinds of museums, if you share any of these, let me know! It is fabulous for me to have a bite of Dutch culture and do as 'Dutch' do. ■

Hello everyone. My name is Sabine Smits and I was born and raised in Eindhoven where I still live with my husband and our son (21). Our daughter (28) lives and works in Amsterdam. Since mid-September I have started as a secretary at the SPS group.

I am originally a nurse, but after the birth of our daughter, the irregular services could no longer be combined with motherhood. After this I did various training courses which I thought could be useful for wherever I was going to work. I gained work experience in various positions at an ICT company, GGD, several hospitals, social work organizations and the TU/e. Before I started at SPS, I worked for several years at Industrial Design and Innovation Lab.

In my spare time I like to travel and explore new countries and cultures. I like to meet up with friends and visit food and music festivals. I'm also manager of a women's hockey team and on Sundays I can be found along the fields of various hockey clubs. See you around! ■

Internship abroad

By: Mark Legters

While the university feels the need to encourage students to go abroad during their masters, I never had to be convinced. For me it has never been a question whether I would go abroad for my internship. It is the chance to be abroad for a longer time without hassle about for example your job.

Before looking for an internship, I thought of going for a destination on the other side of the world with English as the native language, like Australia, New Zealand, the US or Canada. Based on lingual experiences on previous trips outside Europe, it seemed like a safe choice for an internship adventure for me.

However, when I started asking lecturers of my favorite courses for options of an internship, besides some options in the US, Israel popped up as a possible destination. Israel: less than a five-hour flight away, yet located on another continent and being so different culture-wise, and also not a usual destination for an internship. After taking some time to think about it, I decided to put aside the initial thoughts and grab this opportunity.

At the moment of writing, I have been doing my internship for over three months at the Weizmann Institute of Science in Rehovot, located about twenty kilometers south of Tel Aviv. Within the faculty of Mathematics and Computer Science, the SAMPL lab had based itself only a couple of weeks before I arrived in the final week of July. SAMPL is an acronym for 'Signal Acquisition, Modeling, Processing & Learning' – a pretty awesome acronym for a signal processing lab, right?!

Mount Arbel National Park, Lower Galilee

Sunset at Holy Family Chapel, Haifa

The lab being new at Weizmann meant the team being fairly new as well. While some had come over from the lab's previous location, the majority had just started, and the team was also still growing a lot after I arrived. This brought special group dynamics – as everyone was basically new, and still new people were regularly joining the team – and relatively much team building activities, which I all joined. For example, only days after my arrival I was already invited to join a team event with all current team members and their families at the professor's house. Other team activities included a team lunch at a restaurant, a tour at the house of the founder of the institute on campus, and a karaoke event (in Hebrew!) with the local mentally ill shelter, the latter being a quite unique experience.

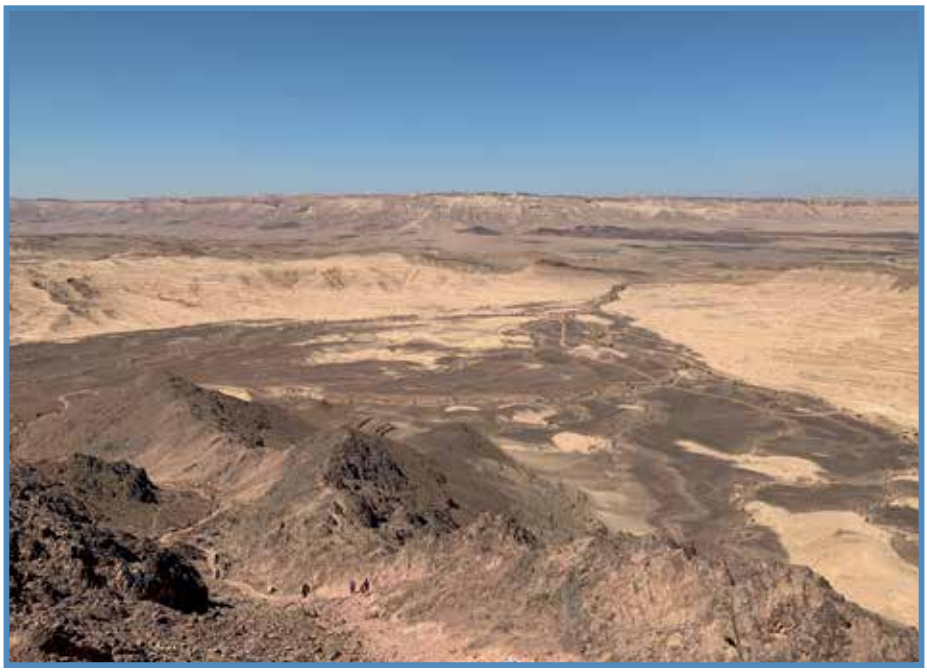
During my internship I am working on the topic of super-resolution in ultrasound imaging. Ultrasonography is fundamentally limited by diffraction limit, which means that there is a limit on the level of detail in ultrasound images. Plain ultrasound images do not show finer structures in in much detail. However, we can construct higher-resolution images by post-processing the images based on prior knowledge of the signal, circumventing this limit. For example, by combining the best of both the classical signal processing and deep learning worlds. This way it is possible to visualize finer vascular structures for instance, which on its turn can help detect diseases better. I have been working on implementing some of the existing methods and compare their performance.

The campus of the Weizmann Institute is well-tended and has a lot of greenery, especially compared to off-campus. It also seems to act as a kind of park for Rehovot, and even newlyweds have their wedding pictures taken on the campus. During the week I spend my time mainly on campus, as in Rehovot itself there is not much going on. While obviously spending the day in the lab, during the evening I usually go for a swim in the swimming pool on campus. However, when the weekend starts, I leave campus to go and explore Israel.

Yehudiya Forest Nature Reserve, Golan Heights: Zavitan Fall, ending up in a big refreshing pool

Traveling in Israel is quite easy, and relatively cheap compared to the Netherlands. As the country is relatively small and Rehovot lies close to the main hub Tel Aviv, all major cities were within reach by public transport for a weekend trip.

As you might know, Israel is home to quite some cultural hotspots. One of my first weekends I spent at Jerusalem, and I got to see the Western Wall at a special occasion: the start of Shabbat. The place was packed with (Orthodox) Jews singing, dancing and praying to celebrate the start of Shabbat. Really impressive! Of course I also visited Tel Aviv, Israel's cultural capital, to soak up the culture at the various neighborhoods, each with its own vibe, and the numerous beaches. Very recently I have visited Hebron, where I got to experience the conflict between Palestine and Israel. Not my favorite topic, but I felt I could not leave without having touched upon this.



View to Mitzpe Ramon (on top of the cliff) from Shen Ramon (Ramon's Tooth) in the Ramon Crater, Negev desert. See the people climbing in the bottom for a sense of perspective.

Apart from the culture-oriented trips, I have mainly been exploring the beautiful nature that Israel has to offer, through lots of hiking. Despite the size of the country, it features quite a range of different terrain, and has a lot of nature reserves. I really liked the mountains at the most northern part of Israel, where I ended up hiking 2,5 stages of the Golan Heights trail, and the natural pools and smalls streams of water ending up in natural pools at En Gedi National Park and Yehudiya Nature Reserve. Also hiking in the Mitzpe Ramon crater in the Negev desert was an experience I would not have wanted to miss. And of course I had to experience the different buoyancy at the Dead Sea.

Another highlight was joining the Sea of Galilee crossing. By chance I came across an advertisement for this event, which is Israel's largest swimming event with yearly over 10,000 participants swimming either 1.8 or 4 kilometers across the Sea of Galilee. I did not hesitate any moment to enroll, and ended up swimming a bit more than the 4 kilometers in the surprisingly warm water, due to some bad signage of the course (or my bad sight).

Now my internship is almost over, I think I can safely say I got the most out of my stay in Israel. I learned a lot during my internship, both in terms of theory and practical skills, but also culture-wise. And on top of that, I got to travel in an amazing country!

Being abroad for such a long time also made me realize how much I like my activities back home. In that respect I look forward to getting back home. But I am thankful for the experiences and what I learned during my internship: the chance to be abroad for a longer time. Don't miss out, grab it with both hands. ■

View during hiking near Klil, Western Galilee

Experiencing the buoyancy of the Dead Sea near Ein Bokek

Institute for Photonic Integration: Change in continuity

By: Andrea Fiore

Since September 1st, the Institute for Photonic Integration (IPI) has a new leadership: due to the upcoming retirement of prof.dr. Ton Backx, I have taken over the responsibility of the institute as part-time Scientific Director. IPI's mission, research topics and commitment to the integrated photonics ecosystem remain unchanged – with new initiatives aimed at reaching out to the students, the public and creating even stronger links with our industrial partners.

Integrated photonics has a long history at TU/e, rooted in the world-leading research activities carried out in various groups within Electrical Engineering and Applied Physics. However, only in the last few years it has also taken a prominent role in the university's profile and in the national research and industrial agenda.

It started with the "Gravitation" grant (20 million euro in ten years) assigned to the TU/e in 2013 to carry out a large research program on Integrated Nanophotonics. But the real impulse was given when prof. Backx became director of the COBRA research school and transformed it into the present Institute for Photonic Integration. His vision was clear: create the right boundary conditions to ensure that research results could be transformed into industrial products and economic value. In order to achieve this, substantial political and financial support was needed, together with an organizational structure which would promote collaboration among the different partners of the "integrated photonics ecosystem": research groups, foundries, design houses, etc.

With a team effort of many motivated people, under Ton's leadership, all of this was achieved within three years, leading to the signature of the PhotonDelta covenant. In this document several public institutions and universities, the research funding agency NWO, and several companies committed to invest 236 million euro in the coming seven years in the further development of integrated photonics technology and its applications. This is the impressive legacy that prof. Backx leaves to IPI and to the integrated photonics community.

The coming years will be equally exciting for our institute and the PhotonDelta ecosystem. The new funding possibilities must be exploited to further intensify our research efforts, collaborating closely with the industrial partners while keeping our identity as an academic research and education organization.

Knowledge transfer from university groups to industry must become simple and efficient – the development of the Photonic Integration Technology Center, an applied R&D center operating within the campus of Eindhoven and Twente universities, will help in that direction. Through the "PhotonDelta Application Labs", short team projects on challenges set by industry, we intend to connect technology and students to real-world industrial needs. Importantly, IPI will reach out – to the public via outreach events (such as the Dutch Design Week, where already this year we had a significant presence), and most particularly to TU/e students, through initiatives such as the PhotonDelta Fast Career Track and the Photonics Eindhoven (PhE) student chapter. These programs will help create a vibrant community of students and researchers with a passion for light and its applications. Integrated photonics is at the verge of becoming a mainstream technology, but it can only do so with the contribution of many qualified and enthusiastic people. This is the time and the place where we can make a difference! ■

The department is recruiting!

By: Jan Vleeshouwers

The Department of Electrical Engineering is recruiting, not just temporary staff (PhDs, Postdocs) but also permanent staff. At the start of this year, there were about ten vacancies, mostly for assistant professors (UDs). This summer, the Sectorplan added another eleven permanent positions to the department, a growth of almost 15%. And apart from that, we also have almost twenty people retiring the coming five years, many of whom senior. All in all, quite a concern, considering the tight job market for Electrical Engineers, in the region as well as internationally, and the additional target we set to appoint equal amounts of women and men on these positions.

Luckily, we are not alone. Other departments at TU/e face similar perspectives and had little success with previous attempts to fill vacancies. In the current job market, filling a vacancy is not limited to finding a person for a position; it also includes assistance in finding a place to live, and very often finding a job for a partner as well. This was the main reason to set up a recruitment office at the university. As of this spring, TU/e has begun to hire a number of recruiters, who were immediately immersed in catching up on some long-standing vacancies. This pragmatic start has resulted in the fact that the department currently has two recruiters, Twan Janssen and Stephan Sonnemans. Twan has twenty years of experience in HR and recruitment, and worked with the Department of Mechanical Engineering, with FEI, and with suppliers of ASML and VDL. Stephan's career as a recruiter is a few years longer, and he also worked with companies very relevant to the department, such as Philips, ASML and Holst Center. These networks are crucial in helping partners of a candidate to find a suitable job.

Twan and Stephan have a quite uneven distribution of work. Twan was the first to start, in April this year, with recruiting for the Department of Mathematics and Computer Science. But quite soon, he was assigned to the Electronic Systems group at EE, that had a couple of vacancies which had shown to be very difficult to fill. He has been taking up the recruitment activities for these vacancies with his namesake group chair, and currently we seem to be close to appointing a couple of excellent people in these positions.

Stephan Sonnemans started the recruiting work in July, and took up all the other EE groups and the Centers. Twan and Stephan see this as the result of a rather 'organic' development of the fact that they were employed to assist in a dynamic process in which the main priority was to get things going quickly. They characterize their work as a combination of reacting swiftly while building relations for the long term. Looking ahead five years is relevant, and for the EE field of positions, relations will probably even need to last longer.

The other characteristic of their work, they say, is that although they themselves are competent in growing a network and keeping it warm, they need to build on the input from the departmental staff. Their ideal is to know everyone, be known to everyone working here, and in addition to that, also know what all our research is about, to a degree. They need to understand why a group is looking for a person with a specific background. That helps in addressing a possible candidate for a position, but also helps in exploring opportunities which do not immediately follow from a vacancy text or a CV.

Stephan and Twan are tech-minded as well as people-minded. They adapt their way of working to complement what our staff can do and wishes to do. It is their work to find the right people to add to our teams. What they wish you to do when you meet them? Tell them about people we really must employ! ■

Icons of EE: Elon Reeve Musk

By: Matthijs van Oort

Most of the famous electrical engineers dedicated their time and effort to fundamental research, and did not bother about bringing cars into an orbit around the earth, but this icon in the field of electrical engineering has put innovation to its limits with his (at that time) controversial ideas. It is safe to say that everyone interested in technology will have heard his name at least once: Elon Reeve Musk. Musk is most widely known for being the CEO of both Tesla and SpaceX, but during his early life he was always busy with engineering and innovation.

Elon was born in 1971 in South Africa, as the oldest son of Errol Musk, who was an electromechanical engineer at that time. He did not have a very easy youth, as his parents split up when he was nine years old and he had to choose between two sides. He eventually chose to live with his father, which he still regrets because he finds his father to be an evil man. While having a tough family life, Elon managed to teach himself to program at the age of ten and built his first computer game when he turned twelve. Elon was not good at making friends, and was bullied for quite some time during his childhood, which eventually resulted in him being able to fight hard when stuff is not going well.

In order to avoid military service, Elon moved from South Africa to Canada before turning eighteen. His dream was to become a technology entrepreneur who would change the world, so he started studying at the University of Pennsylvania in the fields of physics and business in 1992. After completing his bachelor, he went to Stanford in order to pursue a PhD in energy physics. However, this all came to an abrupt end with the beginning of the internet boom.

In 1995, during the start of the internet boom, Elon founded a company named Zip2 with his brother Kimbal. With this company they wanted to create an internet city guide for the newspapers. During the first couple of months, the brothers did not have a lot of money and Elon lived in the office, slept in his car and took his showers at the nearest gym. Elon's main job at this company was to develop the software, and while being one of the founders, he was working as hard as he could in the field of engineering. After becoming a big player in the industry, a company named Compaq bought the company for 307 million dollars (with Elon receiving 22 million).

Right after he sold Zip2 in 1999, he started a new internet company called X.com. The idea behind this company was to change the way people pay and perform banking. It wanted to shift the conventional banking to internet banking, with the world's first online bank. One year after the foundation of the company, Elon became the CEO of the company. However, he would not last in this position for very long, as the internet bubble burst in the same year. Because of the dropping stock prices, Elon was forced to resign and leave the company. This company would eventually become PayPal.

With the amount of money he earned from both Zip2 and PayPal, Elon started looking for new game-changing projects to work on. Musk always looked to make the impossible possible, and started investing his time in creating a way to make space colonization possible. He first tried to lobby for possibilities within NASA, but quickly encountered a wall of bureaucracy and came to the conclusion that NASA did not have an affordable way to travel to space after the release of the space shuttle. Therefore Elon started his own company called SpaceX, with the aim of making reusable spacecraft which could bring people to Mars and back. The engineering challenge was huge, because they had to start building a spacecraft from scratch, but also gave them the ability to design it in such a way that it could be produced relatively cheap. After a few failed rocket launches and with the company on the edge of existence, they managed to successfully launch the Falcon 1 into orbit.

Parallel to his time at SpaceX, Elon started getting involved into Tesla Motors, a company with the mission to build an electric car without compromising for comfort. He first helped the company by advising their board and funding their research and production, but eventually took over the company and became CEO. Elon looks at the car from an engineer's perspective with an eye for detail, and asks the impossible from his engineers.

Overall, Elon is one of the most impactful technology entrepreneurs of today's society. He searches for the edges in technology and pushes them further by dreaming big. A drawback to his urge for progress is that next to pushing the edges of technology he also pushes the edges of the people working for him, demanding a high amount of effort and letting his employees work long days. ■

Whose desk is this?

By: Jan Vleeshouwers

Look behind this desk: it definitely belongs to one of the more privileged among us! But it is not all gold that glitters. The huge fan on the desk was inherited from Martin Hill, when he moved to Australia. When temperatures rise to Australian levels in this office – that happens – the fan and the glass of water keep this desk workable.

You may not immediately notice from the picture, but next to the Jabra speaker, carefully tucked away in a leather pouch, is an old-fashioned pocket calculator. It is an HP device, with the characteristic soft-click keys and the obscure reverse Polish notation, which has stood the test of time. In 1982, when the owner of the desk came to work for Philips Natlab, it was the standard equipment for all of their scientific personnel.

On the other side of the keyboard, there is a black box with various cables. That is a power bank, a small gift of NWO to thank for reviewing proposals. Behind the mug, partly hidden, is the typical plastic container you see on all desks of people in the integrated circuit business.

Do you need more clues? The business card in front of the ventilator is illegible, but the other one mentioning Trymax, makes this desk almost a give-away. This company sells equipment which uses oxygen plasma to remove organic materials from wafers. ■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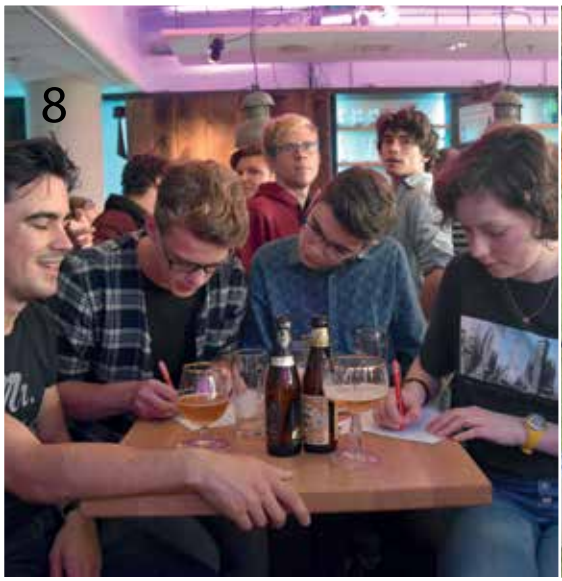


1. ACCI bicycle throwing
2. Lunch lecture Arcadis
3. Exam training Circuits
4. Tappersafscheid Elwin
5. & 12. OkThorberfest
6. Volundr 3D-design workshop
7. Annual GMM
8. ACCI pubquiz
9. ACCI TV deco
10. Constitutional drink
11. Candidate drink
13 . LANCo Mario kart
14. Smack and Chill

A physicist on technology, science and language

By: Jan Vleeshouwers

Most people who think and write on technology happen to be philosopher or historian, and I sometimes suspect that their limited exposure to the daily routine of technology makes it difficult for them to grasp its essence. So the fact that Srđan Lelas was[1] a physicist, made me read his book 'Science and Modernity'. Lelas tries to answer the question what science is: "What is its subject and its object; what is its place in our life-world, and how can it be vindicated?" Lelas composes an extensive and detailed picture of science, and at the same time of technology and language. These three topics (science, technology, language: STL) may well be what most typically and essentially distinguishes the human being from other organisms. In any case, they are tightly interconnected.

In the course of time, philosophers have attributed various kinds of perfection to these three human faculties. For example, they have seen science as a divine gift, or language as expressing absolute meaning. Lelas systematically peels these off. What remains is perfection in an evolutionary sense, i.e. as a species' adaptation to nature which optimizes survival. No absolute qualifications can be attributed to them, such as on truthfulness, objectivity or exactness. Their underlying processes are often untraceable, messy, and full of exceptions. To state this on language may seem to undermine the very attempt to describe anything, but one of Lelas' core convictions is that language works nevertheless. Not in a sense that it will ever be totally clear or error-free, but it allows humanity to achieve a way of collective attunement which is an elementary and important prerequisite for man becoming a dominant species.

Science, technology and language fit into a single picture: the picture of how organisms interact with their environment and how this has developed over time. This interaction has a range of aspects: organisms obtain food (energy), they move around (if they can) finding resources and avoiding danger, and they build niches. On a general level, they observe and sense, they interpret and they act and manipulate their surroundings; as a result they stay alive and are able to reproduce. Generally, life forms on earth perform this interaction through more or less specialized parts of the organism's body. This applies to macroscopic scales (limbs, shells, eyes) but also to the cell level, where there are unidirectional channels for ions and surfaces which bind specific molecules. Organisms have developed a nervous system which produces the appropriate response to specific excitation; in its most elementary form it provides simple pre-programmed behavior, but in the course of evolution the behavior grows more complex and attains a larger degree of adaptability. Evolution has polished adaptations in countless ways, leading to a most remarkable diversity which often breathes a sort of exotic perfection.

The tendency towards growing specialization of body parts has reversed in primates, and most remarkably so in humans. Compared to other mammals, the human body is ill-equipped for obtaining food, avoiding danger and manipulating the world, and much less specialized. On the other hand, it has a nervous system which size is out of proportion and which takes many years to mature. A new-born human is far from being able to survive on its own. Human evolution has shifted away from pre-programmed physical specialization towards a much more versatile, externalized specialization. Instead of growing tools, humans make them (technology). Instead of noses and eyes, humans use nature's abundance of mechanisms to collect and sort out information (science). Language overcomes the volatility of individual development, and provides the glue to prolong acquired knowledge across generation boundaries. For all this, the large and plastic brain is the physical conditio sine qua non. In Lelas' words, it 'completes' humanity, i.e. it results in an organism which is able to survive.

This development towards versatility provides humanity with a variety of possible 'modes of living', substantially larger than other organisms. According to Lelas, the way in which a human society prepares to survive shapes its thinking, its language and defines the

1) Srđan Lelas 1939-2003. His book 'Science and Modernity' is from 2000.

way in which science and technology are summoned to take part in the effort. STL adapts to the specific mode of living of a society: they follow, they do not lead. At best, there is mutual dependence. But there is no autonomy for science or technology.

Science, technology and language are firmly established in mankind, but it is collective only. A human who grows up in isolation, does not develop language, and does not develop technology or science. There is a propensity for language, for scientific and technological behavior but there is no genetic (biological) bootstrap mechanism. The indispensability of STL makes Lelas conclude that the set must be considered as much part of human evolution as the biological part; together they are an integrated whole. For that reason, he considers teaching and learning of utmost importance, and he specifically stresses the importance of transferring skills. In Lelas' view, it is underestimated how much is implicitly learned from working together with experienced scientist and engineers, especially since scientific and technical work can only be systematized to a certain degree. I think he is right.

Where will this lead to? "Science is neither the Divine Gift, nor the epitome of Supreme Reason, nor a privileged inquiry into Rational Cosmic Design. Nowadays… it has become what it has always been in practice - a lonely human venture. From the dark depths of our world ever new possibilities spawn and science brings them about for us. It can even tell us how to establish stable sustainable relations with our planet, how to live in harmony with nature, if only we can find harmony in ourselves. It provides us ample information but little wisdom; it does not tell us how to live a meaningful life, though it can still teach us how to appreciate the world we live in." With respect to science itself: "Whatever the next stage in the ceaseless flow of history will be, science will share the fate of the mode of living it grew out of." Science "is as transient as is everything human." "We can, perhaps, protect science from its full commercialization, bring science and philosophy together, and with their help change our mode of living in a deliberate and controlled fashion. How likely is this to happen I do not know."

From a practical perspective, that is probably not the answer we would have hoped for. But I see a framework for discussing many of the topics which currently absorb us, such as mission-drive research or artificial intelligence. And Lelas interconnects a number of topics in a way that ask us to humbly reconsider what we are doing in technology and science, and why. That is always a good thing to do. ■

Goodbye Rabia and Meeuwis

Since the June 2016 issue Rabia Zainab Syeda has been a member of the editorial team, she has been mainly responsible for the PhD thesis defense articles that were published in this magazine. Meeuwis van den Hoek has been a member since the September 2017 edition, he was one of the layout editors. Meeuwis also took care of handing out the vlaai for the puzzle prize winners and the vlaai for the most (un)fortunate or special event/ person of the department.

We regret to see both members leave.

Thank you very much for your hard work over the years. ■

My life after EE

By: Giel Op 't Veld

Stop planning your career. You can't do it, it's pointless to try and even more pointless to worry. This advice was given to me at a training earlier this year. As someone who just spent ten years of his life planning everything years in advance, this was quite a paradigm shift. Nowadays, I am a management consultant — a job not very common for EE graduates but the one where I needed to be. Due to my love for planning, though, I took a bit of a detour.

Hello world

Probably the younger Connecthor readership does not recognize my picture anymore. I guess I've been away for too long. To be fair, my time at our department was a bit shorter than usual. I started in 2007, when the average time for an EE degree was still 7.5 years.

Around campus, I was known as that one "nominal guy"; the N=1 sample of someone who actually did the curriculum as it was intended on paper.

The TU/e for me was an incredible rush of opportunities. Every year I tried to take a small extra step of extracurricular activities: from year councils, education committees, organizing a Thor study tour to Japan to eventually becoming chairman of Groep-één in the university council. I am still amazed that the Flux building once was a PDF on my hard drive and that the Bachelor College contains elements I fought for. It was a lot of fun, yet also tough; I always thought it would be impossible for me to ever in life work as hard as I did back then. Ironically, I ended up finding a job doing exactly that.

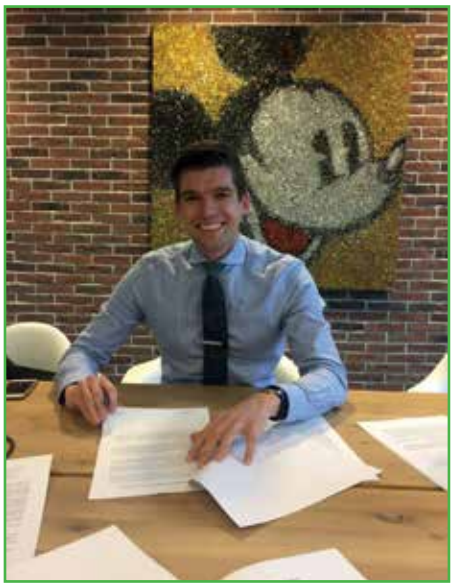
A thesis with a view

The rush of my student life was also how I ended up in a one-way plane to Switzerland a few months after graduation. While grabbing his coat and running out of the building, professor Frans Willems tapped me on the back on his way out and said: "Hey, do you want to go to Lausanne, because I can make that happen. Have to go now, talk to you tomorrow." Two weeks later it was settled, two months later I left.

During my internship in Singapore, I decided I wanted to go for a PhD, but only at an institution abroad. My rationale was that I had experienced such amazing things at the TU/e already; what more could one learn from staying in the comfort zone? Most professors were willing to put in a good word for me, but Frans Willems was the least shy to just bluntly ask a friend to take me on.

Did I know anything about Lausanne? Hardly. It is a key strategic partner of the TU/e in Europe and is always among the top European schools in the rankings. As Eindhoven is less-known but better than Delft, Lausanne is less-known but better than ETH Zürich. Obviously, I am biased.

I ended up spending 4.5 years on the shores of Lake Geneva, overlooking the Mont Blanc massif. The summers in Switzerland were incredible: blue smoke would cover Lausanne's shoreline park each day from all the people enjoying an outdoor barbecue and a dip in the lake.



The winters were of course for skiing; the university even had its own chalet for which the sports center would organize trips every weekend. It's a crazy feeling to stand on the slopes and say "Hey, I can see my house from here!".

Yet, irrespective of Lausanne's beauty, people who know me also know that I have been very critical about doing a PhD. To be honest, I was not in the right place. I found it slow, but above all I missed being challenged on my soft skills. A former Thor president introduced me to a career in management consulting right when I had booked that one-way flight to Switzerland. The timing was off; but the idea stuck. In 2017, I got hired at the top firm McKinsey, two months after handing in my thesis and one month after moving back to the Netherlands.

Engineer hiding under a shirt and tie

As a service, consultants crack whatever hard problem a company or institution might face. How should an energy player align its operations with the shift to distributed power generation? How can a pharmaceutical player leverage advanced analytics to optimize its R&D

pipeline? How should a manufacturer design its factory floor to maximize throughput? Big organizations sometimes find themselves stuck in their habits, or encounter problems they have never encountered before. In such occasions, the outside-in perspective and expertise of a consultancy can be of value. Whatever situation I am in, there is always some colleague somewhere in the world who has seen it before.

To solve these problems, management consulting is not very different from academic research: we spend significant time in just structuring problems and breaking them down into their root drivers. Developing a recommendation for a client is like proving an academic theorem: is my logic sound and have I undisputedly proven this is the right course of action for this company to follow? Engineers and mathematicians tend to do well in this field as they feel right at home with the rigorous structure and tough problems to crack.

Consulting is unlike academia for the "soft skills challenge" that follows the research. We must also convince our clients of our recommendations. Unlike what we engineers might like to believe: presenting factual evidence is not enough to move most people, let alone big organizations. You deal with emotions, political agendas, stubbornness, a multitude of stakeholders or simply unwillingness to change. Recently, one client even threw the F-word at me, only to turn around one hour later and accept our approach. I can't say I saw an academic conference ever get so heated.

Do I still use my degree in electrical engineering? In terms of content, no. In terms of skills, absolutely. Logic, structuring complex issues, statistics. I look at a business problem and abstract it in my mind to what I learned in my optimization courses: what's my objective function, solution space, constraints and how does my objective behave as a function of my input variables? So far, my projects brought me to chemicals, pharma, civil engineering, metal, banking and a multitude of places: I'm putting the final touches on this story from an Uber outside Boston, USA. I do hope to branch out to topics closer to my education. The dream? Helping high-tech in the Brainport region, of course! ■

Internship abroad

By: Kyle van Oosterhout

Salt Lake City, situated in the north of Utah on the west side of the United States, home to the University of Utah, is the place where the Utah Electrode Array, one of the few microelectrode arrays that is allowed to be implanted in human brains, has first been developed. It is also the place where I have spent four months doing my internship on this very special electrode array.

I could not have thought of a more hectic start of four months very far away from my family and friends. Due to large delays and uncertainties I could only apply for my visa less than a month before my internship would start. When trying to make an appointment, I found out that the first open spot for a visa application was mid-August, two months after I was supposed to start. Luckily I managed to urgently request an earlier date for the appointment, two weeks before I was supposed to leave.

This sounded great, until I realized that I should get documents from America by post before this appointment to show them, and those documents were sent to me exactly one day before the appointment. The only solution was that I went to the embassy and my father would drive to the postal distribution center to get my package and hope the line would be long enough for my father to arrive on time with the documents. Luckily, it all just worked out in the end, because for once I was happy that the total time it took before it was my turn was three hours.

Only when I got through the customs and sat comfortably in the plane I was truly able to relax. Against all odds, everything worked out fine, I was on my way to the United States. Only after being greeted by my supervisor, a tour of the campus and a quick unpacking of my most important belongings for my very temporary first Airbnb stay, I realized that I was completely alone here, my friends and family were more than 8000 km away from me.

The Utah culture

Americans are very friendly people. I luckily found that out already in my first few days at the University of Utah. I had to arrange a lot of things, like getting a social security number, setting up a bank account and getting a more permanent place to stay, as my Airbnb was only booked for one week. Everyone was glad to help me and really took the time to explain to me the things that were different here from the Netherlands, and so my life in the States could start.

My colleagues also welcomed me with open arms. I was immediately invited to a boating trip that Nick and Navid were planning the second weekend I was in Utah, which helped me get to know a lot of wonderful people from all over the world. I did not feel like the odd one out at all, because I realized that as a Dutch citizen you might be one of the most American people around in a university with a lot of international students.

A fun fact about the Utah culture is that Utah is seen as a strange state, even amongst Americans. There are a lot of active rules against the use of alcohol, such as that there are no kegs allowed in the state, as well as that draft beer can have a maximum of 4% alcohol by volume, and higher alcohol percentages may only be sold by government-owned liquor stores. Even though some people do it, it is also not allowed to drive to another state for alcohol, as Utah is the only state that forbids alcohol to be brought into the state by the public.

During summer there is always something to do in the city. I found out for example that every Tuesday there was a Swing-styled dance lesson in downtown after which a Jazz band would play for the rest of the evening to allow some social dancing, which was always great fun. The bands were of very high quality and all of the musicians were from Utah itself. The best part of it:it was completely free of charge. The Netherlands could learn from that!

Because Halloween does not really exist in the Netherlands, I wanted to mention that Halloween is a lot of fun in the US. Super scary haunted houses open up everywhere around the city, and cycling through the city you also see a lot of the houses being decorated with skeletons, spiders, graves, and most importantly, red lights that make the already beautiful houses even more beautiful in the night. They also organize a lot of fun activities in October, like a 5 km run where zombies try to chase and catch you.

The environment

Utah is one of the most beautiful states in America. Salt Lake City is situated in a valley, surrounded by mountains on three sides and the giant Great Salt Lake, a more than 5000 square kilometer salt-water lake, on the other side. The mountains are great for mountain biking and hiking, and I heard they are also great for skiing. Unfortunately I left just too soon to take advantage of the skiing season. It is easy to find any type of hike you like, from short hikes of only an hour to multi-day backpacking trips.

A bit further to the south there are five beautiful national parks: Zion, Bryce Canyon, Canyonlands, Arches and Capitol Reef. All of them are unique in their own way and if you like mountain biking, around the national parks there are some of the most unique and amazing mountain bike trails I have ever seen. It is easy to get a group of friends together, rent a car, drive there for a weekend and camp under the beautiful stars in places it is so dark that you are able to see the milky way and a lot of shooting stars.

Another great trip I did was a backpacking trip to the Fifth Water Hot Springs for the birthday of a friend. We hiked a beautiful trail up towards the hot springs in the late afternoon, and found a camping place on sundown. We then walked further up to the hot springs where we could lay in water of any temperature we desired while watching the beautiful unpolluted skies. It is also allowed to make campfires on many mountains, and of course the perfect way to end such an evening is by singing songs around a warm, self-made campfire.

The University of Utah

Now that I have convinced you that you definitely have to go to Utah, I will also talk a bit about the University of Utah where I did my internship. As already stated in the introduction, the University of Utah, or the UofU as they call it here, is the place where the Utah Electrode Array is developed. This device was the reason for me to come here. I was able to work on the whole development sequence of this tiny device, from the moment it was still a wafer up until the development of software to interpret the neural data, which will eventually be used in a larger project where they try to allow a paralyzed patient to drive a car again.

The University itself is situated relatively high in altitude, so from most buildings you can look out over the whole city, which is especially magnificent at night with all the lights. It does however make it more difficult to move to the campus by bike, because the slopes can get rather steep. Luckily, you adjust to it easily and after a week I stopped being exhausted from it.

The University of Utah is very much focused on healthcare applications, which makes sense as it is not only a technical university, but also a medical university, and it has some very specialized health institutes. This makes this university a perfect choice for students who want to specialize more into the medical side of their studies. I also met a lot of medical students here and it is always great to talk to them about their research and your own.

Conclusion

Even though it was very scary to be all alone on a different continent, far away from the people I knew, it only took me a week to make a group of new friends that just kept on expanding over the weeks. When at first I thought: "How am I going to spend all this time here?" at a certain time I forgot to take some time for myself to do laundry and to cook as I had so many things to do. I definitely had a great time here and I would recommend everyone to do an internship far away from your home as it will allow you to get to know a country in a very different way from going on holiday and you will make friends that will stay with you for the rest of your life. ■

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WWW.AME.NU

The ThEW

By: Guus van der Ven

The Friday (September 13, 2019) the ThEW started, when we got our route, we expected that the ride would go smoothly. However, this could not have been a greater misconception. After a few missed turns and a lot of sandy cycling paths, we finally arrived at the location where we would be staying for the weekend. While we drove up the driveway we saw the Praesidium (or at least a part of it) for the first time. One by one we were let inside. Here we had to say goodbye to our phones and we got a cup and an egg. After that, we were told to make our beds.

When we were done making our beds, the first egg was already broken and it wouldn't be the last one that night. After everybody was ready the cantus could begin. And because for most of us it was the first time participating in a cantus, we didn't start so smoothly, but after some beer (or ranja) our singing got a lot better and our enthusiasm knew no limits.

After the cantus, we got a little sleep and we were rudely woken up. We were told to put on some clothes, after which we were shoved into a van for a dropping! At the first post, we saw a few former board members. At the next post, there was a group of active members of Thor. And finally we were greeted by the "tapauto" and the "Tappers".

After breakfast the next day, we were told to get our hammers and we got to build catapults in three groups. Our goal was to hit a target. After everybody had tested their catapult with a varying degree of success, we went to the city for a "vossenjacht". Once we returned, there was BBQ waiting for us. After the BBQ we enjoyed a campfire and met up with the kandi's, to which we sang our self-made songs.

The next day after we packed our stuff we went canoeing with all the kiddos and the kandi's. After a lot of hours canoeing, we were very tired and now we could finally cycle to Flux. ■

Antwan's adventures

By: Lars Essenstam

Hello there, my name is Lars Essenstam. I am currently the President of Scintilla, the sister association of Thor in Enschede. Today I will be telling about the adventures of Antwan. Antwan is our noble steed that we ride on our trips to Eindhoven and other places. Antwan identifies itself as a unicorn, which is quite logical as he has a big horn on his forehead.

Even though Antwan has not been around for a long time, he has had quite a harsh and interesting life. It all started at the so-called candidate round (kandi-rondje), where he visited several associations. He carried many people throughout the day, standing proud and tall everywhere. Without our noble steed, we would never have survived our candidate round. When wrapping up the candidate round, Antwan visited Eindhoven for the first time. Antwan enjoyed his stay there a lot, as it was the first time he could enjoy a nice view from such a high building. Unfortunately for us, Antwan liked his time in Eindhoven so much that he decided to stay in the Thor room. Although this broke our hearts, we had to accept Antwan was growing up and wanted to explore the world. We felt like he had the right to become more independent and find out more about itself.

It felt like years, we missed Antwan every day. Sometimes crying our self to sleep, however, we always had the comforting thought that Antwan could care for himself and was enjoying his time. Then the faithful day came, it was our constitution drink and we saw a figure, standing proud and tall, with a horn towering above all other people. It was Antwan. We were glad he returned safely, and he has been enjoying his time in Enschede

since then. He made a quick visit back to Eindhoven for the constitution drink of

Thor, however, all his adventures have made Antwan worn down. He is not able to stand up without a quick fix. Therefore, Antwan does not make many trips anymore, however, he can for sure visit Eindhoven again. ■

MaxWaves

By: Ronis Maximidis

MaxWaves is a new spin-off initiative in the Electromagnetics Group at Eindhoven University of Technology. Our mission is to bring high data rate gigabit connectivity to even the most remote places around the world. We want to bring to everyone the opportunities and services which are only available in large cities nowadays. A high data rate with reliable connection will bring new applications to these regions, like mobile banking, remote healthcare, and education. It will be even more crucial with the arrival of 5G, which will enable new applications like, remote surgeries, massive Internet of Things, and automation.

The problem until now has been that there is no affordable and reliable solution for high-speed data connections of these remote areas to the core network. Installation of optical fiber is expensive and economically inefficient, while classical wireless and satellite links have limited data speed. For example, the total cost of ownership (TCO) for a 10GBps connection in Germany is shown in Figure 1.

This figure clearly shows that even if we use the pre-installed optical fiber network, dark fiber, the associated cost is at least two times higher compared to microwave links, even for moderate distances. The stepped increase in the cost of the microwave solution after 3km is due to the use of an additional low-frequency link in order to support the required reliability. In the same report from Ericsson, it was suggested how to achieve 10Gbps connectivity for, urban (<2 km), suburban (<8 km) and rural (<15 km) development scenarios. For the rural scenario three antennas working in the classical frequency bands (6-13GHz, 15-23GHz, 26-42GHz) were used, which results in increased system complexity and cost. This number of links is required due to the small bandwidth available in each of the bands. The channel capacity C is directly related to the available bandwidth B and the signal to noise ratio S/N by the Shanon-Hartely theorem

$$C = B \cdot \log_2\left(1 + S/N\right) \quad (1)$$

From equation (1) it is clear that by increasing the bandwidth, we can increase the data speed supported by the link. Large bandwidth is available at higher E-band (70-90GHz) frequencies. By operating at these frequencies, we could reduce the number of required antennas to one and even support data rates above 10GBps.

Problem at hand

There is an important challenge in the use of the higher frequencies, like the E-band. At higher frequencies, the signal strength decays much faster with propagation distance, thus limiting the maximum communication range. The signal losses, L, versus propagating distance R, can be calculated by the well-known radio equation:

$$L = \left(\frac{4\pi R}{c} f\right)^2 \quad (2)$$

where c is the speed of light and f is the frequency. A way to compensate for this decay is to concentrate the energy in a specific small area by using, for example, a reflector antenna, similar to dishes used for satellite TV reception. The gain achieved by concentration of the energy by a reflector with diameter D, and efficiency ε, can be calculated approximately by

$$G = \frac{\pi D^2}{c^2} f^2 \cdot \varepsilon \quad (3)$$

From equation (3) you can see that the reflector's gain increases with frequency, which means that we would not need to use very large reflectors. Using the same antenna on the receiver side we can double the benefit, and therefore increase the distance even more.

But, there is always a "but", the concentration of energy results in a very narrow "laser" beam, the width of which decreases with an increase in frequency. An approximate equation for the beam width of a parabolic reflector antenna is:

$$Beamwidth = \frac{70c}{f \cdot D} \quad (3)$$

This means that in order to cover large distances, we need a large reflector (Figure 2) which concentrates all the energy in a narrow, "laser" type beam (Figure 3). Now we have to align two very narrow "lasers" beams at a distance of at least 10 km, which is almost impossible to achieve with conventional alignment tools, and moreover, we cannot see them. Besides, a slight misalignment of one of the antennas during operation, due to wind, temperature variations or other environmental effects, will

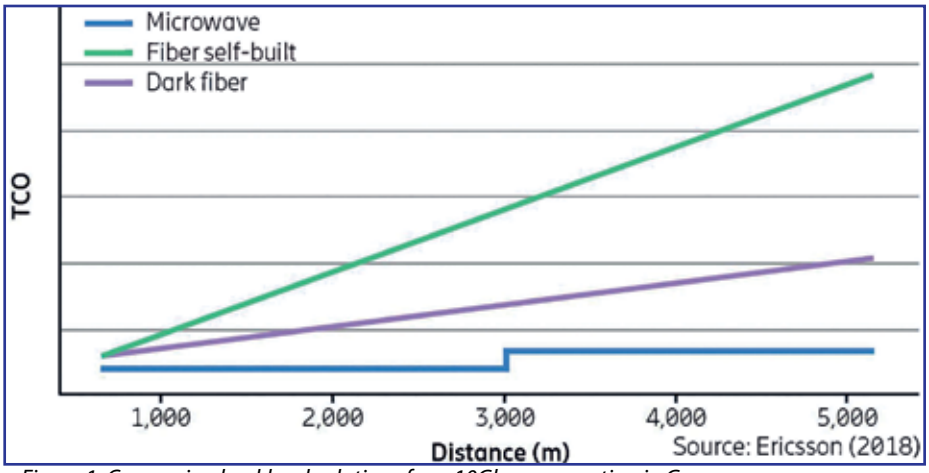


Figure 1. Comparing backhaul solutions for a 10Gbps connection in Germany

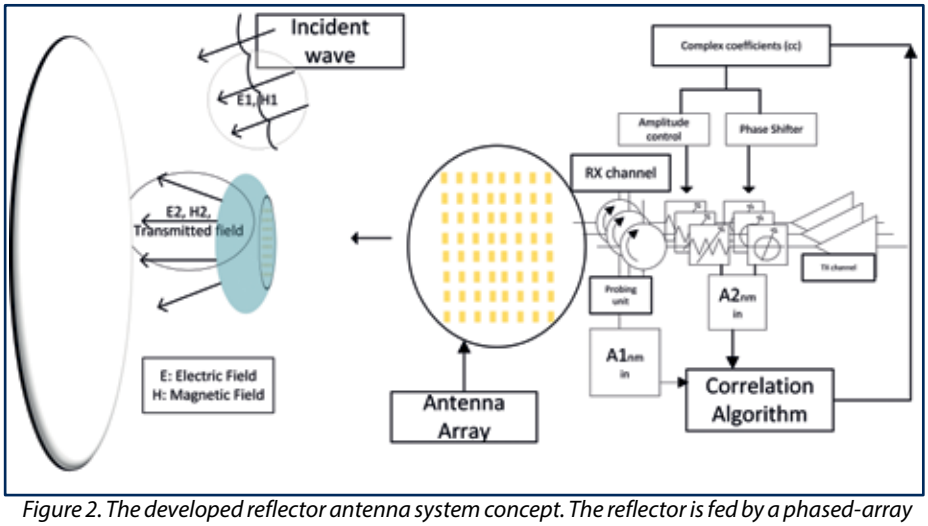


Figure 2. The developed reflector antenna system concept. The reflector is fed by a phased-array feed to enable electronic beam steering.

simply destroy the communication link. Therefore, this solution is impractical, or better, was impractical until now.

TU/e Innovation

In our department, we have developed and patented a unique technology which can solve the aforementioned problems. Using this technology a solution can be developed that can assist the high gain antennas' installation process and compensates for the antennas' misalignment. To achieve this, a header of the reflector antenna is replaced by a constellation of small antenna elements (see Fig. 2), resulting in a so-called focal-plane array.

By choosing the correct position for these antennas and controlling appropriately the relative signals of each of them, it is possible to steer the beam to the desired direction electronically without mechanically moving the antenna system itself. In addition to this, since we use multiple antennas we can dynamically adjust the radiated power according to the link's needs.

Birth of MaxWaves

Having this technology in our hands and seeing clearly the problem that we can solve, we decided to commercialize it. So the spin-off, MaxWaves, was born. As a first step, we applied for and successfully got the NWO Take-off I grant and MRE subsidy. The available funding allowed us to develop further our business proposition and, most importantly, enabled us to develop a system-level prototype to test our technology in the real world, see Fig. 3.

It consists of a reflector antenna, which has a small sub-reflector positioned around the focal point and a constellation of small antennas placed in a hole at the center of the large reflector. This configuration allows us to place all the electronics behind the reflector and use it as a heat sink. The mm-wave electronics are highly inefficient and generate a lot of heat. By using adaptive power control we can reduce the wasted system power and help to achieve global sustainability goals.

The prototype was tested on the TU/e campus. For these tests the transmit and receive antennas were placed on top of the Vertigo and Flux buildings, respectively, which gives a test distance of 500m.

During our two-week extensive tests in October 2019, we confirmed that we are able to perform the misalignment compensation as well as dynamic power control. You can watch the promo video made during the test here:

https://www.youtube.com/watch?v=Ga8_qDqKFD4.

Having the working prototype was an important milestone achieved by our newborn company. Our immediate plans are to further develop the prototype and test it in cooperation with mobile operators. We believe that in the near future we will be able to bring to the market a reliable long-distance solution to support the introduction of 5G to remote areas around the world. For this we will need help. So, if you are a highly motivated student and you want to work with a cutting-edge technology which will improve the lives of millions, please contact us. www.maxwaves.tech

If you are interested in our developments, please follow us on LinkedIn:

https://www.linkedin.com/company/maxwaves ■

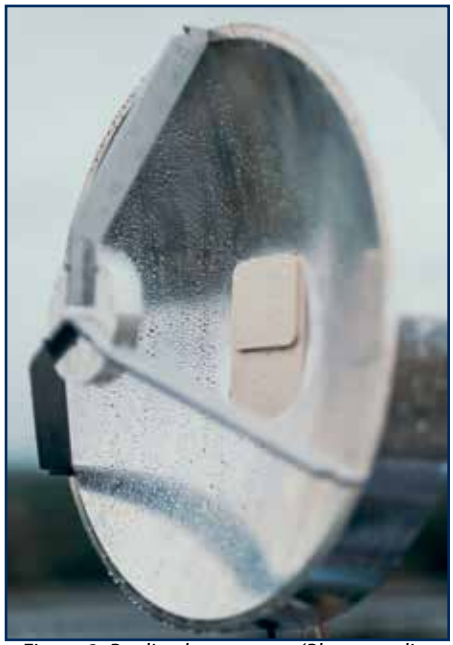


Figure 3: Realized prototype. (Photo credits: Ksenia Korzun)

Figure 4: First field trials between Flux and Vertigo. (Photo credits: Ksenia Korzun)

1957 Party

By: David van Son

It was the first Monday of 2019 when an e-mail from the E.S.C arrived. In it was the question whether we would like to try to organize the 1957 party again. The idea was simple: organize a party with the four associations founded in 1957. In 2018, it was also tried to organize the 1957 party. However, we were not allowed to organize an event on the first Monday of the year, the opening academic year. This year however, the Executive Board of the university decided to allow us to organize an event on the first Monday of the academic year.

With the Executive Board's permission in the pocket, we started meeting. The plan was made quickly, we wanted to start with a barbecue and drink on the campus. After the barbecue we would go to the Ballenbak for an after-party. The plan was clear, but how many people would want a barbecue on the first Monday of the year? We had no clue, but thought that one hundred people per association sounded reasonable. We had a target.

Organizing a barbecue for four hundred people is not as easy as it sounds though. First up, we needed meat, this was the first hurdle we had to take. The butcher would be able to deliver four hundred portions of meat, but only if he knew the order a week ahead. This was a problem, because we didn't think we would have enough enrolments by then. We would be able to promote the barbecue all through the introduction week, but then there is already so much going on, how would we stand out?

Luckily, we had a break, the butcher could get our order a few days later, as long as we gave a good indication of how much we would need. Our deadline was moved to the day of the book sale. This turned out to be perfect, because on that single day, our enrolments quadrupled from one hundred to just over four hundred! We had achieved our goal, despite we had almost completely given up hope.

The day came, Monday September second, it was going to be a long day. There was more than enough to do: get the tables, prepare the barbecues, set up the tents, you name it. We were immensely lucky that our volunteers, also known as (candidate-)Board members, were so helpful, and thanks to them, everything was ready at 16:00h. The party, or actually the drink, could begin!

The first people started to show up, the barbecues were started and the beer started to flow. As more and more people showed up, it rapidly became busy, but still cozy. The barbecues quickly became flooded with people, while the bar was busy giving everyone something to drink. It turned out to be a great strategy to get a beer before queueing for the barbecue.

For us, the evening flew by, and before we knew it, we stood in the Ballenbak enjoying the after-party. Looking back, we think it was a very successful event. We had beer, we had food and we even had a nice after-party. In short, nothing to complain. We hope to see many more editions of the 1957 party in the coming years! ■

Cycling to Norway in the winter

By: Sander Verdiesen

A few years ago a friend and I were complaining about the fact that The Netherlands hadn't seen a white Christmas in several years. We thought the only way to have a white Christmas was to head up north to Norway. Both of us had an old 1980s road bike and we decided this was the ideal means of transportation. Yes, we had had a few beers. Several months later we had done little preparation, but spurred on by the promises we had made to our friends and family we headed to Bergen, Norway.

On average we cycled 150 km each day through snow storms, hail, rain and the occasional ray of sunshine. We had some very high moments as well as some very low moments. Despite all the hardship, we made it to Bergen with some great stories to tell.

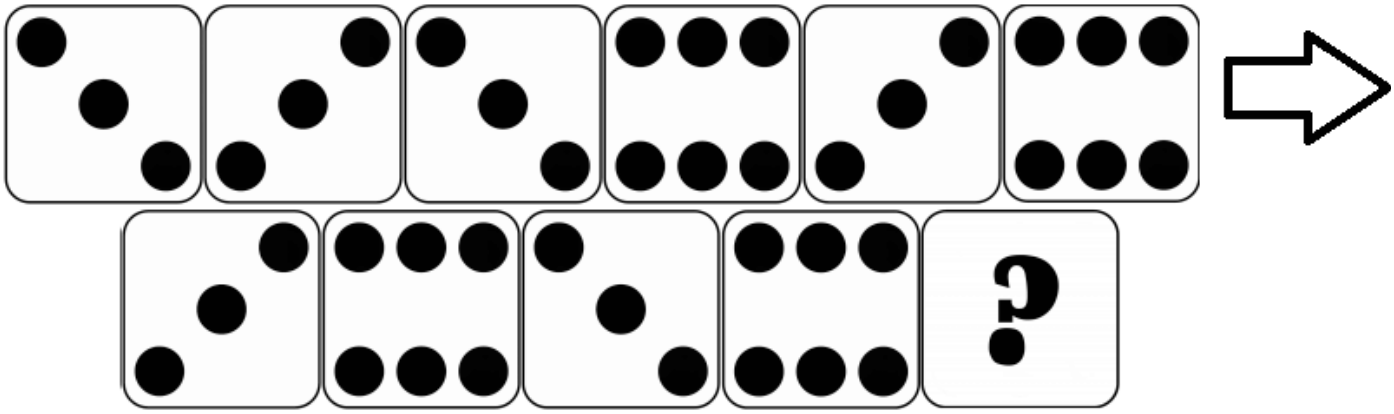
I vividly remember how tired we were on Christmas Eve. We had just cycled through the rain and the cold until we found ourselves in the city of Kolding, Denmark. Given that it was a holiday, no shops or restaurants were open and all we had left was some rice and some spices. Nor did we have any sleeping accommodation. Luckily my friend spotted a small shed at the parking lot where we were resting. It appeared to be empty so we put our stuff inside and started preparing our Christmas meal. I remember feeling miserable at the time, but still able to enjoy the moment. This is my most memorable Christmas Eve ever.

Our first day of cycling in Norway we had to take a ferry across a lake. Once we arrived, a snow storm was brewing. The crew of the boat wished us good luck, but I don't think they believed we would make it. At first the snow wasn't too bad and we were able to make quite some progress. However, one of us got a flat tire and although both of us have quite some experience doing bicycle maintenance, we were unable to change the tire until we reached a bus shelter to get out of the snow. After a while our brakes frozen up which made the descents extremely frightening. But we simply had to plough on, because quitting was not an option.

Eventually we did make it to Bergen on our bicycles. We had convinced some friends to come pick us up in Bergen with a van and we spent a few days in Bergen before making our way back home, telling stories and reminiscing about the adventure the entire way.

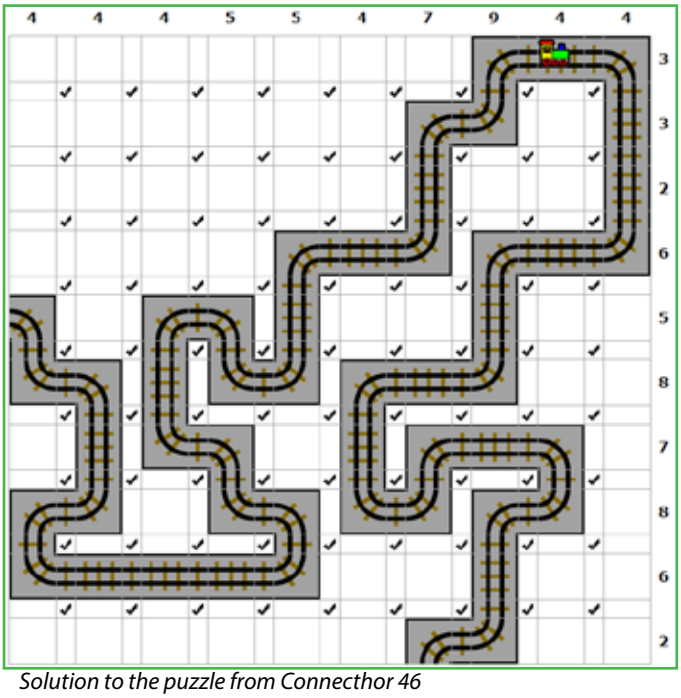
This story goes to prove that people are capable of so much more than we think, as long as we are willing to push our boundaries. I am thus a firm believer that everybody should step well out of their comfort zone every once in a while. You might fail while trying something spectacular, but know that there is only one thing worse than failure: regret. ■

Puzzle



Complete the pattern of dies

Which die should be next? If you know the answer, send it to connecthor@thor.edu and you might win a delicious pie!



Solution to the puzzle from Connecthor 46

Steven with his prize, congratulations!

Answer - Whose desk is this? (page 15)

This edition's desk belongs to Huub Ambrosius! Would you like to have your desk featured in the next edition? Please contact the editorial board of the connecthor via connecthor@thor.edu and we might feature your desk in the March edition of the Connecthor.

What is your mental age?

By: Tom van Nunen

Not many people like to be told that they're wrong, especially not by someone lower in rank than him/herself. Being corrected by a child is of course completely out of the question; adults know everything and children have to listen to them at all times, right?

In this regard, I understand the responses of many people to the climate activists, the striking children in particular. Why on Earth should you listen to a child that is not even eighteen years of age? Shouldn't they be at school, learning how the world really works? Whatever you do, please stop pretending a child can be smarter than I am.

Can't they see how beautiful this actually is? The next generation, standing side by side, united for a better future. The ones that will be in charge only in many years, concerned that what we're doing right now is not what we should be doing, worried that it might soon be too late. I must say that I admire them for all their efforts, and the fact that they are able to mobilize so many of them.

I think we can learn a lot from children. This includes the times they are unintentionally funny for their (wrong) choice of words or explanation of phenomena, but that is not among the main causes I want to address here.

Children are very creative. Some crayons and a sheet of paper can bring out the true artist hidden inside. Everything is possible, there are no limits: mama is taller than our house, the cat has wings, and trees have faces. Just be sure he confines his creative expressions to the paper, and leaves the walls alone.

I don't know about you, but during my childhood, I've had loads of fun building tree houses in the forest. The best were the stories that we came up with: our secret base in the run for gangsters, you name it. And if a random kid came along, chances were that he could join just like that. This extends to the fact that children can entertain themselves with close to nothing. Give them a stick, a rope, a pencil, or a ball, and off they go. Just make sure to be back in time for dinner, and please don't hurt other children. Who needs fancy new toys?

A child's mind is much more open to the rest of the world. They don't let themselves be bothered by what others think of them, they don't let themselves be judged. Would people think this drawing is stupid? What if people dislike my treehouse? What does it mean for my social status when I express this opinion?

These skills can actually be very useful in the lives of adults. Solving problems without limits. For example, most of us know that no input is wrong when brainstorming, but of course we limit ourselves in the fear of acting stupid in the eyes of others, being remembered as that person who always comes up with ridiculous ideas. Why?!

Also in the design of hardware or software, why not let your inner child create the first design steps? Who knows what kind of revolutionary ideas will see the light?

Don't be afraid to be childish, embrace your inner child. Grab a box of LEGO and build, make a drawing, take the unconventional approach. And please, extend these things to your working environment. Only when someone tells you that you're wrong, that is when you shouldn't be childish, and consider that they might be right, even if only for a very small bit. ■

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