Connecthor

TU/e
EINDHOVEN UNIVERSITY OF TECHNOLOGY

In **RetrospecThor**

EE Education Day 2021

Can you **make a resistor**?

How far are we from **fully automated driving**?

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

56
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Not a lot has changed since last year's end of the year, the Covid-19 virus and its variations are still keeping a lot of us working and studying from home. We, as the editorial team, thought it best to again mail the December issue to the home addresses. What started as a one-time experience has become, so it seems, a new tradition. We hope it brings light to your Christmas break.

On the cover of this magazine, you will see members of the editorial board. As you may notice, the staff members are outnumbered by the student members. If you have ideas for articles and would love to be part of creating a new Connecthor issue every quarter, please let us know. We are looking for more colleagues to come join the team.

You will find many interesting articles in this issue. To name a few; Panagiotis Meletis shares his PhD research on holistic street scene understanding in the article "How far are we from fully-automated driving?". Photos of new Master Graduates can be found on pages 8 and 9. Jan Vleeshouwers answers the question "Can you make a resistor?". Martijn van Beurden wrote about the Education Day 2021.

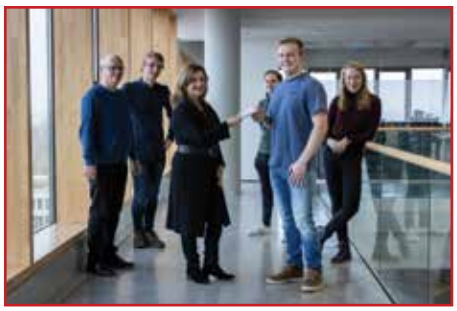
Mart Philipsen, the new President of e.t.s.v. Thor, wrote his first column for the From the President section. You can read about his thoughts and ideas on page 5.

In Retrospecthor; for this 56th issue, Pieter van den Boom, Vice President and Commissioner of Education of the 56th Board of e.t.s.v. Thor, has written all about his experiences.

We take this opportunity to thank Stijn van Himste and Margot Emke for their hard work and dedication within the editorial team and in taking care of the lay-out of the magazine. They have spent many hours in the past years to get the magazine print ready. We are forever grateful.

We wish you a lovely Holiday Season, a very Merry Christmas and a splendid 2022.

The Connecthor editorial board ■



How far are we from fully-automated driving?

Panagiotis Meletis will tell you everything about automated driving and his PhD research in the Mobile Perception Systems lab on pages 18-20.

In RetrospecThor

Former Vice President and Commissioner of Education Pieter van den Boom looks back on his time at Thor, and how it is after he graduated from studying Electrical Engineering. You can read all about it on pages 22 and 23.

Old Skool New School: the EE Education Day 2021

Martijn van Beurden talks about everything that happened on the EE Education Day 2021 in the Evoluon on pages 12 and 13.

Board issues

By: Guus Pemen

As I write this, autumn has finally arrived and it is raining cats and dogs. But that also means that now for almost a full quartile we can enjoy on campus education again. It is great to see our students back on our campus, in our buildings and in the lecture halls. There is commotion and life on campus again, as there should be. In September we also had, after two years, our departmental education day again. It was very nice to meet and speak with all colleagues in person on this beautiful day.

A large survey conducted by the university shows that more than 90% of our students are fully vaccinated against Covid-19. I am very happy with these results and that our students are taking their responsibility now that education is taking place on campus again. The pandemic is not over yet, Covid currently seems to be returning from never being really gone. But the high vaccination rate among our students gives me confidence that the coming education period can also take place safely, responsibly and on campus.

Last June we had our first Departmental Research Day. Although online, it was a beautiful day with good discussions about our departmental research strategy. We would like to organize this research day every year on the second Wednesday of June. So mark your agendas, next year's research day will take place on Wednesday 8 June 2022.

I have already informed you about the EE-nl initiative; the electrical engineering platform that we are setting up together with our colleagues in Delft and Twente. The platform aims at important topics as EE community building, being a discussion partner for organizations such as NWO, and disseminating to society and politics the relevance and challenges of our beautiful field. We are currently busy preparing a kick-off of EE-nl, combined with an EE-nl conference to which all department colleagues from Eindhoven, Delft and Twente will be invited. Just like our departmental research day, this congress will offer a lot of room for interaction and discussion with colleagues, around themes that are important and relevant for the development of our departments and their employees. The conference will take place in hybrid form at TU Delft and via Teams on Wednesday 26 January 2022. Make a note in your agendas! ■

From the President

By: Mart Philipsen

Here we are, a new academic year has started. One that many of us have been looking forward to, whether you are going to university for the first time or have been studying for a few years here at the TU/e. Of course, this anticipation is not just caused by the arrival of a new year and the next steps in your academic career, but also with the changing circumstances that we have been through the past few months. After a year and a half of lockdowns and other regulations, it seems like lectures and other forms of education will be returning to campus more and more in the coming months. It is clear though, that it will take a bit more time before everything is back to how it was two years ago.

For many of us the reopening of the campus, and the possibility to once again organise offline activities, means enjoying parts of being a student that we have not been able to experience yet. This year, this not only counts for the first-year students, but also partly for the two generations above them. Fortunately, we've seen a lot of these students embracing these changes and showing a great interest in actively partaking in activities or even organising them! This can be seen by the sizes of our first- and second-year committees, Ivaldi and ACCI, having 34 and 26 new members respectively. It is great to see two new generations full of new and passionate members.

My generation, however, did experience the first half of a 'normal' year, where we could go to all kinds of activities and parties. The second half of the year, we unfortunately also did not get to experience fully due to the first lockdown. As a Board member, it feels weird to know that first year students will get to experience a full on-campus year at the same time as me. Luckily for us, there is always someone, such as someone from a previous Board or just an older member, who can help us when we don't know what to expect or if we're unsure what to do.

This not only works for us as the Board, but in my first year I also quickly learned that while studying, I could always just ask a random person on the sixth floor of Flux for help. For example, when I was stuck on an exercise from a certain course, two older students sitting on the other side of the 'long table' offered me help when they noticed me struggling with the course. Thanks to them, I learned a lot more than I would have if I had just studied in my room alone. I think it is an important thing to always keep in mind that, together, we work a lot more efficiently than alone and that everyone is happy to help when you ask them. This is emphasised during a Board year, as you quickly learn that not every task or problem can be solved by you alone but requires the help of your fellow Board members or someone else willing to help you along the way.

Veel gedonder!

Mart Philipsen
President of e.t.s.v. Thor ■

Introducing...

For those who don't know me yet. My name is Danielle van der Hagen and I am 48 years old. I was born and raised in Eindhoven where I still live, with my boyfriend and three girls (16, 19 and 19, years old).

I started as a secretary at TU/e at the Eindhoven School of Education in June 2017. I transferred to the Center for Care and Cure Technology (C3Te) at the Department of Electrical Engineering on April 1st 2019 to take up the position of secretary and still enjoy doing so.

As the children grow older and become more independent, I had the opportunity to work more hours. Therefore, I will be the successor of Suzanne as secretary of the dean's office (EE). This position I will combine with my current role within C3Te.

In the past, I have been working for 20 years as a commercial assistant at ABN AMRO Bank. With over 19 years of experience in the banking world, I have always held customer-oriented positions. A characteristic of me is my attitude towards both people and results. I am a team-player and I am known as a committed and loyal employee with most of the time a big smile.

Feel free to drop by to get acquainted!

Hello everyone.

My name is Levy Costa and since October 2021, I am working as an Assistant Professor in Power Electronics, in the Electromechanics and Power Electronics group (EPE) group, Electrical Engineering Department.

I come from Fortaleza, a beautiful city in the northeast of Brazil, where I obtained my BSc degree in Electrical Engineering. After this, I moved to the south of Brazil to study at the Federal University of Santa Catarina, where I received my MSc degree. After that, I moved to the north of Germany, more specifically to Kiel, where I received my PhD degree in power electronics. During this time, I have been working with power electronics and emerging technologies, like solid-state transformers, charging stations for electric vehicles, etc. After my graduation, I spent almost 4 years working as a R&D Scientist at ABB corporate research center (in Switzerland). I am really enthusiastic about promoting sustainability and I believe that our expertise can be used to make a better world.

During my spare time, I like to play guitar, spend time with my family and watch movies. I look forward to meeting more friends at the TU/e.

Hello, my name is Vibhor Jain. I'm 22 years old and I'm from Indore, India. I started my PhD journey in the Electronic Systems Group in September. Just before coming to TU/e I was at IIT Kharagpur, from where I got my Bachelor's and Master's degree in Electronics and Electrical Communication Engineering.

Before starting the PhD I've worked on multiple projects related to the automotive sector, mainly focusing on smart vehicle technologies. For one of these projects I lead a team that prototyped an EV from ground up, with the project eventually converting into a start-up. I also worked in semiconductor manufacturing industry during my internship with Intel where I worked on streamlining the process of formal property based verification for memory subsystems.

I really liked working on cutting-edge technologies and realized I wanted to spend more time in academia. So, at TU/e I will mostly be working on developing and implementing strategies for Vision-in-the-Loop systems, with primary focus on perception tasks and their performance on edge computing platforms.

I'm a motorsport fan so on the race weekends I enjoy watching Formula1 (keeping my fingers crossed for Max this season!). I also play guitar and love classical rock music in general and I'm always planning the next trip to the mountains. Looking forward to meet new colleagues at TU/e!

Hoi allemaal! My name is Paola Escobari Vargas and on September 1st I begun a PDEng program in the Electromagnetics department of EE. I am from Bolivia, a country located in the heart of South America, I studied my BSc in Electronics Engineering in Bolivia and my MSc in Radiofrequency and Microwave Engineering at the University of Surrey in the UK. I also did a training course on satellite applications in China and worked afterwards for the Bolivian Space Agency for 7 years! Most of my work and research was focused in satellite applications and communications and I also taught at universities. My project is focused on designing an antenna in package using very novel 3D printing technologies for 5G applications with a company called CITC located in Nijmegen and afterwards compare the performance with conventional technologies. I have many hobbies, I used to play the violin and the saxophone, I also practiced many sports but the main ones are basketball and volleyball, I love nature in many ways and try to spend as much hours possible doing voluntary work (helping people in rural areas, kids, animals, planting trees and so on). Hope to meet you all!

Hey! My name is Raquel Alves and I recently joined the Electronic Systems (ES) group at TU/e to work at the UMOSA (Unobtrusive Monitoring of Sleep Apnea) project as a PhD candidate.

I was born and raised in Porto, Portugal and I've done my bachelor's and master's degree in Bioengineering at the Faculty of Engineering of the University of Porto. In 2019 I was also able to enroll on the exchange program ERASMUS+ where I went to Groningen and that was when I first fell in love with the Netherlands. After I finished my degree in Portugal 2020, I started working as a R&D engineer at a small start-up company in Aveiro, Portugal, where I developed my taste for signal processing, remote monitoring and the use of cameras. The UMOSA project arrived as merge of my passions for both the Netherlands and my work. Here I am fully committed into develop my skills, learn a lot, and thrive in my career.

I hope that the ES group and the TU/e family can make this experience much more enjoyable.

Hello! My name is Nazanin Farid Mohajer and my Ph.D. journey in the EM group started in August 2021.

I have received both my master's and bachelor's degree in Electrical Engineering from the University of Tabriz, Iran, in the same city that I was born, grew up in, and enjoyed its snowy winters. Last year, I joined the Radio Systems group within Electrical Engineering at the University of Twente as a master's student where I have harmonized my understanding of electromagnetics theory and wireless technologies. As we are moving to mm-waves, there is a need for test environments based on realistic scenarios to characterize RF components and wireless devices. That being the case, the goal of my Ph.D. project is to emulate different propagation channels within the reverberation chamber which is within the framework of the European-funded MyWave Project.

I'm not only enthusiastic about electromagnetic waves but about sound waves too. I'm a classically trained pianist. From time to time I enjoy painting and you can always amuse me with a good story and a book.

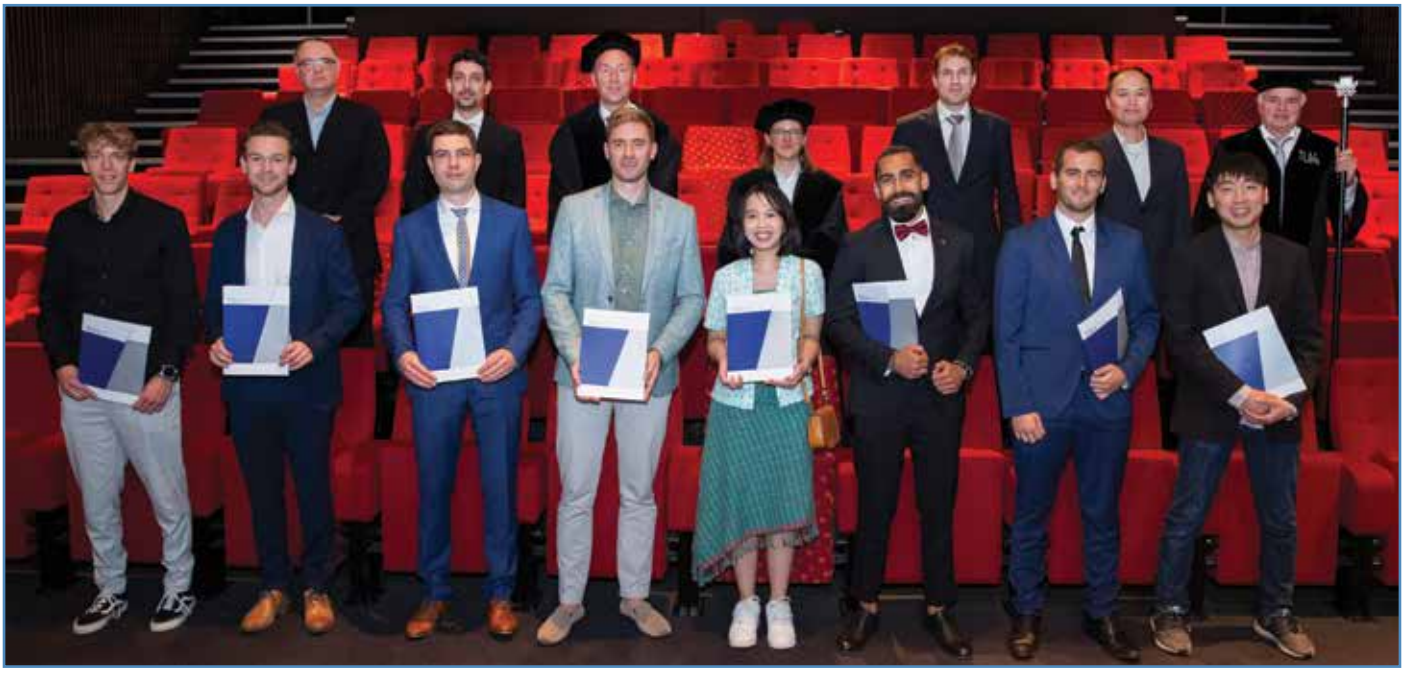
Hi all, I am Yannick Heuts and I have just started my PhD at the CS group. In 2016 I started studying at this university, first doing the Bachelor "Automotive Technology" and after that the Master "Systems and Control", which I finished with the thesis titled: "An Adaptive Restart Heavy-Ball Projected Primal-Dual Method for Solving Constrained Linear Quadratic Optimal Control Problems". During my PhD I will be working on the "Efficient and environmental friendly LONG distance poweRtrain for heavy dUty trucks aNd coaches" project or LONGRUN for short.

Besides research I also like fixing up my recently bought old-timer (MG Midget mk3), watching new series and movies and spending time with friends and family.

Master Graduates

Congratulations to all the Graduates who received their Masters degree on October 19th, 10:00.

Casado Ramoneda, A. (Aitor), Krikken, W.M. (Wouter), Luong, D.Q. (Dat), Abboud, I. (IBRAHIM), Rombouts, M.P.G. (Marijn), Leenders, G. (Gido), Perez Sosa, M.B. (Maira), Vijayadharan, K. (Kannan), Erol, and O.H. (Onur Hasan).



Congratulations to all the Graduates who received their Masters degree on October 19th, 12:00.

Saraswati, (Nitya), Čiurlionis, J. (Jokūbas), Gelderen, J. van (Jos), Nes, N. van (Nick), Chehab, M.K. (Khaled), Mulder, G.A. (Geert), Hu, L.S. (Lan), and Mourik, P.J. van (Patrick).

Congratulations to all the Graduates who received their Masters degree on October 19th, 14:00.

Daverveld, D.P.P. (Daan), Driessen, L.H.P. (Leroy), Tataj, M.E. (Michalina), Galesloot, E. (Esmé), Lauret, D. (Dirk), Aken, S. van (Sophie), Lande, M. van de (Maurits), Struijk, M.M.C.J. van der (Mariska), Trân, P.L. (Linh), and Hegde, V.G. (Vinutha Gotnakodlu).

Congratulations to all the Graduates who received their Masters degree on October 19th, 16:00.

Reep, T.J. (Tom), Noord, K. van (Kris), Onat, N.B. (Nehir Berk), Scholte, D. (Dick), Hakvoort, J.C.P. (Joost), and Nguyen Huu Minh Hoang, (Hoang).

Can you make a resistor?

By: Jan Vleeshouwers

Can you make a resistor? If you said 'yes', are you aware of how special that is, even in a community of (to-be) electrical engineers? From careful observations and analysis we know that knowledge of how to make something (engineering knowledge, or skill, if you prefer), develops like Brownian movement, not as a straight line. The source is not just the books you studied; it also takes some amount of talent, quite a lot of practice, a rich amount of failures and perhaps most importantly, the help of others with experience. An individual journey, with limited reproducibility and difficult to retrace.

Perhaps you don't bother since you can buy resistors of any value and kind in a nearby shop. It sure is practical that not all those who need resistors, should have to make them themselves. But suppose no-one knew? The knowledge of how to make resistors is important, if not crucial for our present-day society. At the same time, it is not too obvious who keeps this knowledge, and how it is learnt.

This holds for many man-made things in our environment. It is helpful here to set apart engineering knowledge ('making') from scientific knowledge ('understanding'), although the differences are gradual. While scientific knowledge is supported by a large and growing body of publicly accessible texts, engineering knowledge is much more elusive and hidden, to some level taught and practiced in vocational schools but for the high-end part often located in private company production processes, or even more private, in the experience of specialists (technicians, engineers and others), who would have a hard time expressing and explaining their 'making' knowledge, if they are possible to do so at all.

To prevent misunderstanding: engineering is not 'applied science'. In reality they are symbionts. Hendrik Casimir phrased their mutual dependence as 'the science technology spiral' [1], which is even a better image of how they influence each other. The characters of scientific and engineering knowledge differ quite a bit. With a bit of exaggeration, you might say that scientific knowledge is like reading, while engineering knowledge, as exemplified by the resistor of the introduction, is more like reading between the lines. Experienced engineers are sometimes said to "know where to look". The process of creating and perpetuating engineering knowledge is a kind of art which evades analysis and specification much more than does scientific knowledge.

So if you want to understand the concept of resistance, you can get very far by just studying books, videos, podcasts and a lot of other material quite freely available in the privileged wealthier countries. But if you want to make a resistor, you are off on a much rougher track. You may start with a charcoal pencil line on paper, but even then you already need sophisticated equipment to determine its value. After that, you will need to address accuracy, stability and reproducibility issues. The relevant expertise exists, of course, but it is unlikely that you are able to tap into it as easily as you can find scientific publications.

In a sense, you may say that the problem of securing engineering knowledge has been solved on a societal level, with the quirks, complications and imperfections these solutions usually have. Perpetuating engineering knowledge results from the interaction of a lot of individuals and organizations; together they somehow manage. We may not know exactly how we do it, but we do.

For a university, this is not a satisfactory answer. At TU/e, our core business is technical knowledge, scientific as well as engineering. We are supposed to know what we are doing and why, and we are also supposed to evaluate the work of our staff and the progress of our students.

With respect to research: TU/e is not where we make resistors, or, for that matter, anything else. We are a technical university which uses scientific knowledge to make new things and advance the ways in which we make them. We stop before all the nitty-gritty details have been sorted out (TRL 3, say). In the meantime, however, we have been collecting a wealth of engineering knowledge, through all the experimental work, through the development of prototypes, through our handling of matter of all sorts. But this knowledge hides a bit beneath the surface, is difficult to pinpoint, and develops even if not explicitly cared for. This specialized engineering knowledge hardly ever makes it into publications. Still it is essential for the research. It is hard to overestimate its relevance. Without it, not a single laboratory would produce anything useful. And because it is often concentrated in a single person, if this person leaves, the lab's continuity is endangered.

With respect to education: TU/e is a place where engineering knowledge is taught. We do, but it is not easy. Knowledge is in people, not in books or anything else, and learning is the process where someone masters knowledge, based on all these imperfect external sources: printed material, texts, videos, teachers, fellow students. We have teaching thanks to the fact that we are able to structure a substantial part of this process, especially if the knowledge is in the area of basic science. But the closer we get to engineering, the more elusive the character of knowledge and the more difficult the teaching. We see this in our education: we desperately need practice, in labs, in projects, in teamwork, in CBL, and with a low student-to-staff ratio, allowing personal feedback. It is all because we cannot tell our students to study engineering knowledge by the book.

With respect to evaluation: Dutch universities are in a process of finding more appropriate ways to assess the value of scientific work [2]. There is a general consensus that publication and citation numbers, the amount of funding secured, or the personal grants received, are relevant but do not paint a complete picture. Educational and organizational talents remain in the shade, and there is hardly any recognition for that fact that every scientific result is a team achievement. And above all, as I hope is clear from the introductory paragraphs above, new and specialized engineering knowledge is quite difficult to recognize and value. So it is a big problem how to create a proper mix of metrics and narratives which cover everything included in the scientific work.

At TU/e, we distinguish four domains of scientific activity: education, research, impact and leadership. This is a rather obvious classification, but finding balanced criteria for each, certainly in mutual relationship, is hard. I think it would help if we explicitly included the science-engineering dimension into the picture. It is a little awkward that we talk about 'scientific staff', while these are all involved in both science and engineering.

Using the specific engineering dimension, two aspects emerge: it is important to be good at making, and it's important to be good at teaching others how to make. It is important to have internalized a substantial amount of implicitly coded engineering knowledge and it is important to be a source of this knowledge for others. So the engineering parallel of publications is makings, and the analogue of citations is use. Within the context of 'Erkennen en Waarderen' we should focus at least as much on what our staff makes as on what they publish. At least as much on use as on citations. This is very similar to what the Strategy Evaluation Protocol (SEP) [3] already identifies as research quality for quite a long time. But we may give it some body and status, e.g. by registering makings as structurally as publications, and use as structurally as citations. We need something like a 'TU/e inside' signature for technology which includes our engineering effort.

Knowing 'how to make' is not limited to creating full-fledged new products. Important steps toward a final product are proofs-of-concept and prototypes. These are equally worthwhile to consider for research quality, perhaps even more so, since they are limited to essential functionality and are a better source for teaching. The creation of artifacts is surrounded by laboratory setups for building, measuring and testing. These are engineering 'makings' as well, with usually a high level of uniqueness and a low level of robustness, so a perfect and fragile gathering place for engineering knowledge. The continuity of a lab will very likely hinge on this knowledge, so although there is no direct external effect of maintaining and developing a lab, it should be valued highly as part of an evaluation.

What about evaluating the quality of teaching engineering? You should probably not think of courses, but – see above – of practice-directed educational activities. These are much more informal. Perhaps you should note whom students turn to for questions. Who in your group would you ask for assistance with an experiment? Whose presence on the lab floor have you missed most during Corona? The answers may very well indicate quality of teaching engineering.

Evaluating academic work deserves covering the full spectrum from science to engineering. In one aspect, evaluating the engineering-end of the research spectrum is definitely easier than the science-end: there is always something concrete which can be shown. So the basic question, relevant to research as well as education, would be "What can you make? Please show me". Perhaps even a resistor. ■

[1] 'Het Toeval van de werkelijkheid', H.B.G. Casimir, 1983, Chapter 10. See https://www.dbnl.org/tekst/casi003toev01_01/ (Dutch only).

[2] 'Erkennen en Waarderen', see https://recognitionrewards.nl/

[3] Strategic Evaluation Protocol: https://www.vsnu.nl/en_GB/sep-eng.html

Old Skool New School: the EE Education Day 2021

By: Martijn van Beurden

For the first time in more than two years, the EE educational day was held, a gathering for staff involved in teaching to be updated on developments in teaching and education, to discuss and exchange ideas, and to also enjoy the setting outside the university. The latter has put quite some pressure on the organizers to find yet another location that excites enthusiasm among the staff. This year, we were in for a special treat: the Evoluon!

For those of my generation and before, the announcement that the event would be held in the Evoluon probably might have brought back some old, and hopefully happy, memories. For me, it was one of the earliest encounters with complex technology that I was aware of. Next to the great environment, the education day was an opportunity to meet colleagues from the department after many months of solitary confinement in which we had only virtual access to our academic environment. It was a joy to meet up with familiar faces and to get acquainted with quite a few new ones. After an informal welcome at the reception desk, where we each received a personalized handwritten badge featuring a stylistic version of the Evoluon, we were received with coffee and tea and it quickly felt like the "old days".

Morning program

The first part of the morning program consisted largely of updates on the department's educational developments, such as the influx is students: an amazing total of 277 for EE and AT in the Bachelor and about 136 in the Master EE. Further highlights were the announcements regarding an upcoming redesign of the Bachelors EE and AT and a new elective track Neuro Engineering. This was followed by updates from ESA's side, where several new faces were introduced.

After the coffee break, Maarten van Rossum presented the new plans for professional development within the curriculum, with the aim of supporting students in their future careers. Ilse Fölker then gave an overview of the Pathways platform, created as a support system to stimulate students in getting a proactive attitude towards their employability with a key role for coaching. The morning session was closed with a lunch outside in the sun with a view on the iconic dish of the Evoluon.

Workshops

The afternoon session held two workshops, for which the attendees were distributed over two groups, based on the color of the personalized badges received earlier that day. For me, the first workshop was on Professional Development by Maarten van Rossum and Bibi Linssen. They had prepared a number of Mentimeter questions to get us started on thinking about professional

development. This was followed by small group discussions centered around four central questions, one of which was: "What form of guidance should our students receive and to what extent should teaching staff be involved?" Each question, written on a large piece of paper, received input from a group and the paper was then passed on to a next group.

The second workshop was held by Els van Rooij and started off by the wEEtjes quiz with a knock-out system. Each question was answered by holding up a yellow or blue card and if the answer was wrong, you had to sit down and stop answering the questions. In my group, the knock-out ended well before the batch of quiz questions had been finished and therefore Els gave us a second chance. This was followed by an overview of finding on learning and teaching during the pandemic. Finally, the group was subdivided into four smaller groups that each had to pick a challenge and come up with a 1-minute pitch to solve the challenge.

The final session in the official program contained a wrap-up of the two workshops, followed by the educational awards for best teacher in the first, second and third year of the Bachelor phase. This time, the winners were: Rik Vullings in Signals 1 (5ESE0, 1st year), Mark Bentum in Electromagnetics II (5EPB0, 2nd year) and Alex Alvarado in Communication Theory (5ETB0, 3rd year). Congratulations to these great teachers!

The day was completed with a tasty barbecue dinner outside, the sun still out on the terrace, and colleagues discussing both the educational day and the personal experiences from the past period. And while the sun was slowly setting, the educational day came to an end. ■

Rik Vullings, winner Best Teacher Awards EE 2020-2021 1st year

Mark Bentum, winner Best Teacher Awards EE 2020-2021 2nd year

Alex Alvarado, winner Best Teacher Awards EE 2020-2021 3rd year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1. ACCI fristipong
2. & 3. 256th GMM
4. First Thursday party
5. & 6. Constitution drink
7. Exam training Computation I
8. Career Day
9. Lunch lecture Alstom
10. Lunch lecture Route to a PhD
11. Intro+
12. Denryu lab equipment auction
13. LANCo Mario Kart

The never-ending learning journey

Nontas Rontogiannis has the rather narrow sounding job title of Software Architect within the Software Innovation Team at ASML. But what Nontas loves about his job is how wide it really is – the freedom it gives him to be creative, to be challenged and to learn and grow.

Nontas: "I was always a curious child – always asking questions, wanting to know how everything worked, especially technology. It was natural then that I went on to study Electrical & Computer Engineering." When you meet Nontas, you see immediately how energetic he is. Collaborating more, learning more and getting more hands-on with people and industry is in his nature. In 2015, he came to the Netherlands for a PDEng in Software Technology at the Eindhoven University of Technology. His graduation project was at ASML, and his experience there was enough for him to eagerly take up a full-time post in 2017.

A technical university in a box

"My primary motivation for choosing ASML is the machines we make. For a curious person like me, an ASML TWINSCAN system is like a technical university in a box! Every possible engineering discipline is inside – cutting-edge physics, mechanical engineering, electrical engineering, software…you name it," says Nontas. "And you can explore them all – you not only get to work alongside other disciplines; you have the opportunity to move around and develop yourself wherever you want to go."

Maintaining a code base of more than fifty million lines of code

"Well, I don't have to dress head to toe in a cleanroom suit," laughs Nontas. "Depending on the day, I start by getting together with my colleagues to discuss the latest challenges on modelling software using state machines. It is important to align and engage with different engineering communities within ASML, like the one here at the Veldhoven headquarters and in Wilton and San Diego in the US. We use mathematics to prove certain properties of our software and create architectural patterns that not only enable us to get the most out of the machines, but also ensure that the codebase of more than fifty million lines of code is maintainable. To achieve all this, often we have to join forces with academia. Every week is different, you never stand still, and what's great is the culture of open collaboration – no idea is off-limits. Everyone is here to learn from each other in order to push the boundaries together."

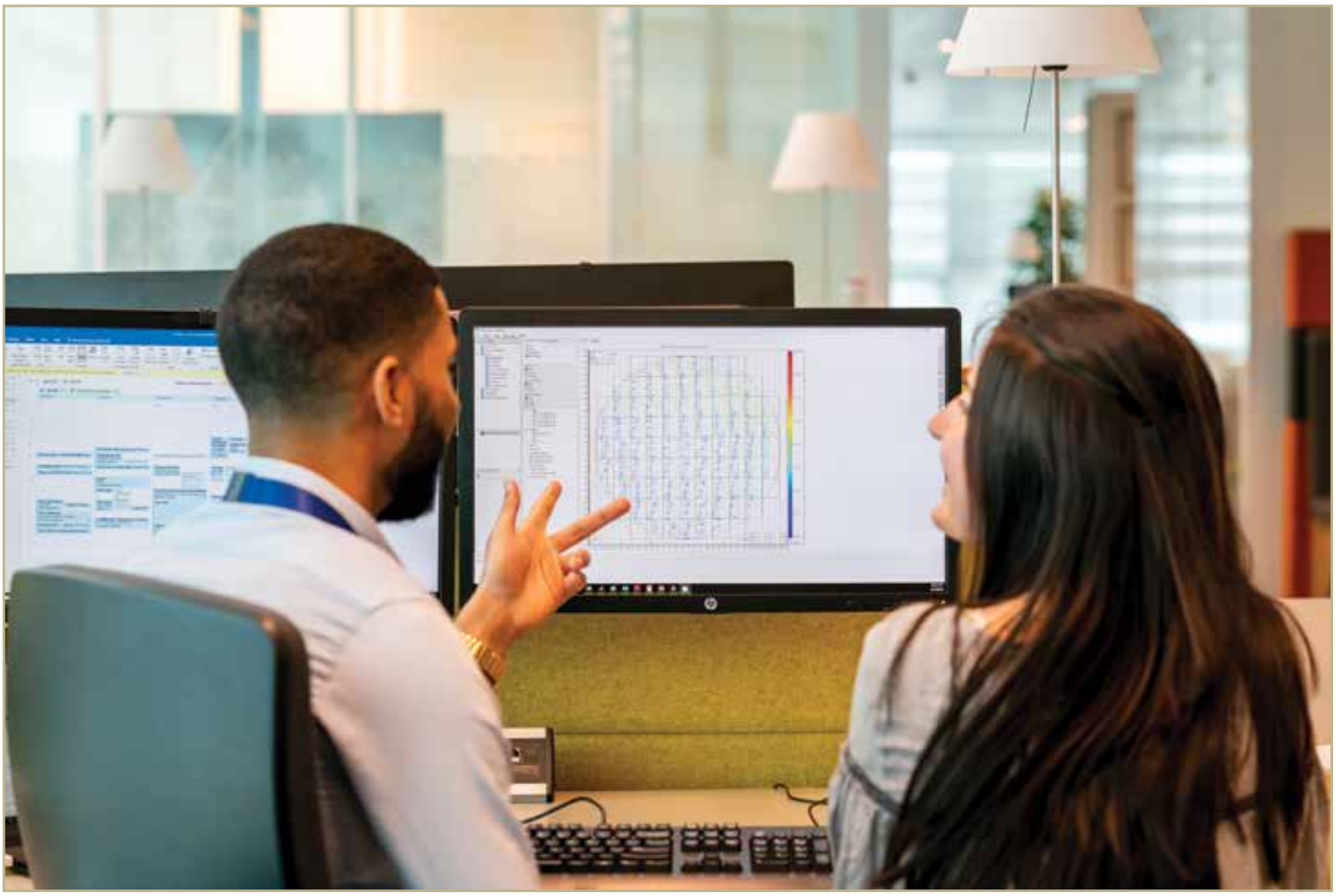
Nontas Rontogiannis, Software Architect within the Software Innovation Team at ASML

Programs to invest in technical talent

Nontas enjoys that his learning journey never stops, and he makes the most of extra opportunities. He follows, among others, the ASML Technical Talent Program – a two-year program providing an all-round technical and non-technical lithography domain training. "This program shows how ASML invests in its technical talent. It inspires me to give back too," he says. As such, he volunteered to become a mentor to future talent as part of the student ASML Technology Scholarship: "To me, the more you put in, the more you get out. And the more I learn, the more I can teach others."

Some final advice from Nontas? "Dare to dream big!" he says. "Don't settle for OK, when you can do better. And ASML is definitely one of those places that dares you to dream big and where you can always be better. Your career options are only limited by your ambitions."

Are you interested to learn more about ASML? Visit www.asml.com/students for more information about our events, internships and scholarship program.



Company profile
ASML is a high-tech company, headquartered in the Netherlands. We manufacture the complex lithography machines that chipmakers use to produce integrated circuits, or computer chips. Over 30 years, we have grown from a small startup into a multinational company with over 60 locations in 16 countries and annual net sales of €14.0 billion in 2019.

Behind ASML's innovations are engineers who think ahead. The people who work at our company include some of the most creative minds in physics, electrical engineering, mathematics, chemistry, mechatronics, optics, mechanical engineering, computer science and software engineering.

Because ASML spends more than €2 billion per year on R&D, our teams have the freedom, support and resources to experiment, test and push the boundaries of technology. They work in close-knit, multidisciplinary teams, listening to and learning from each other.

If you are passionate about technology and want to be a part of progress, visit www.asml.com/careers.

Get in contact with your ASML Campus Promotor!
Our ASML Campus Promotor at the TU/e is Lisanne van Dijk.

You can get in contact with Lisanne via Lisanne@workingatasml.com.

Lisanne van Dijk, ASML Campus Promotor at the TU/e

How far are we from fully-automated driving?

By: Panagiotis Meletis

Self-driving cars are emerging in our everyday life, while one decade ago were only idealized. Technologies like cruise control and lane centering are becoming a standard in every type of car. The leaps in automated driving that are observed in the decade are associated with advances in a variety of factors, including the enhancement of infrastructure and legislation in many countries, as well as the consumer acceptance for this new technology. However, the largest breakthroughs that lead to the deployment of automated driving are related to the recent advances in Artificial Intelligence (AI). AI technology is becoming the driving force of self-driving cars and innovation is needed now more than ever. This article presents the status of automated driving and related AI technologies and summarizes the contributions of our Ph.D. research performed within the Mobile Perception Systems lab of TU/e.

Automated driving nowadays

When driving one of the latest available car models the driver gets fascinated by several autonomous functionalities. Lane centering keeps the car inside the driving lane, and cruise control maintains a constant speed, a feature that is particularly useful in the Netherlands. Lately, self-parking is also incorporated in some cars and discharges the driver from performing demanding maneuvers. Although these autonomous capabilities assist the driver to a great extent, it is still needed that a human driver sits behind the steering wheel for safety reasons. Moreover, automobile companies often advise disabling these systems inside city traffic.

Panagiotis Meletis and the autonomous car of the Mobile Perception Systems lab. Processed image by the developed AI system. Photo by Lieke Vermeulen.

Levels of driving automation

The Society of Automotive Engineers (SAE) has defined 5 levels of automation from level 1, where automation merely assists the driver, up to level 5, where no driver is needed. All the exciting functionalities mentioned in the previous paragraph are just classified as level 2 or level 3 driving automation. Level 2 automation, like Tesla's Autopilot and Cadillac's Super Cruise, can take full control of the car but the driver must be prepared to immediately intervene. Level 3 automation, partially included in Audi and Honda's Sensing Elite systems, needs a limited amount of driver attention. As can be seen, in the last decade driving

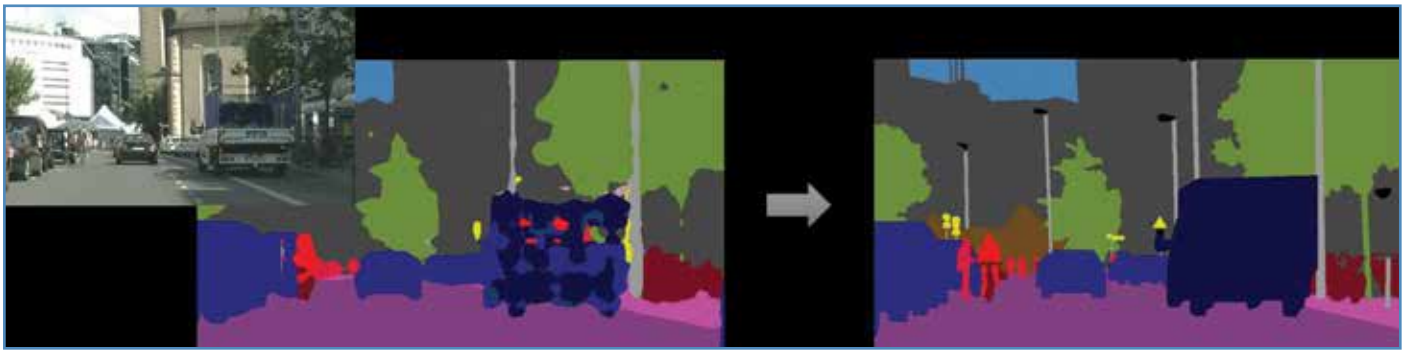


Figure 1. Scene understanding accuracy. Colors represent traffic concepts, e.g., car in blue, cyclist in red. The top left image is processed by a baseline network (not incorporating our improvements) and the results are shown in the second image from the left. The right image demonstrates the ideal accuracy and detail.

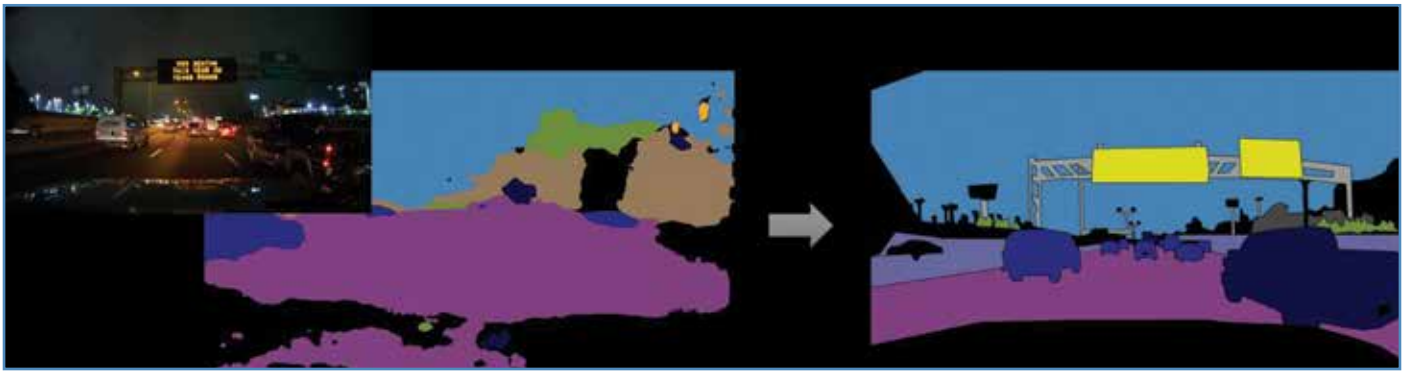


Figure 2. Scene understanding generalization for night scenes. Colors represent traffic concepts, e.g., car in blue. The top left image is processed by a baseline network and the results are shown in the second image from the left. During night the system's accuracy is severely degraded.

automation has progressed from level 1 to level 2, but the automation that these systems provide is not universally applicable to all roads and conditions around the globe.

AI in automated driving

The enabling factor of automated driving is the rise of Artificial Intelligence (AI). AI has the potential for progressing driving automation to higher levels by sharpening the "brain" of an autonomous car. The "brain" should perform three vital operations: perceive the environment, make decisions, and finally control the car. Our research within the Mobile Perception Systems lab is specialized in accomplishing the first operation, which is the environment perception/understanding, using Convolutional Neural Networks (CNNs). These networks are inspired by the human brain and can be trained on images of traffic scenes and learn how to analyze their content. The results of the analysis are subsequently used in systems created by other researchers in the lab. These systems predict future actions of traffic participants, and eventually, take decisions and control the car. The following paragraphs present our contributions to street scene understanding for supporting automated driving.

Fully automated driving demands leaps in road infrastructure, legislation, consumer acceptance, and technology. Even if we regard the first three to be progressed enough, technology still requires years of innovation for the ubiquitous deployment of automated driving.

Accurate street scene understanding

Automated driving needs to be reliable and accurate, either on a sunny day with high visibility or a foggy and rainy night. Thus, the scene understanding system should perform well in a variety of expected and unexpected conditions. The first goal of our research is to increase the accuracy of scene understanding in all kinds of conditions. We achieve this by exposing the CNN to a variety of images from different environments, cities, and times of the day. The trick lies in combining many existing datasets and using them all together to train a single CNN. This is similar to having a person driving around different cities, challenging roads, and difficult environments, hence becoming an experienced driver. Combining datasets is not trivial but it entails challenges. We devise the necessary algorithms for addressing these challenges and thus, we are able to train the CNN to make better predictions, as shown in Figures 1 and 2, to resemble an experienced driver. ▸

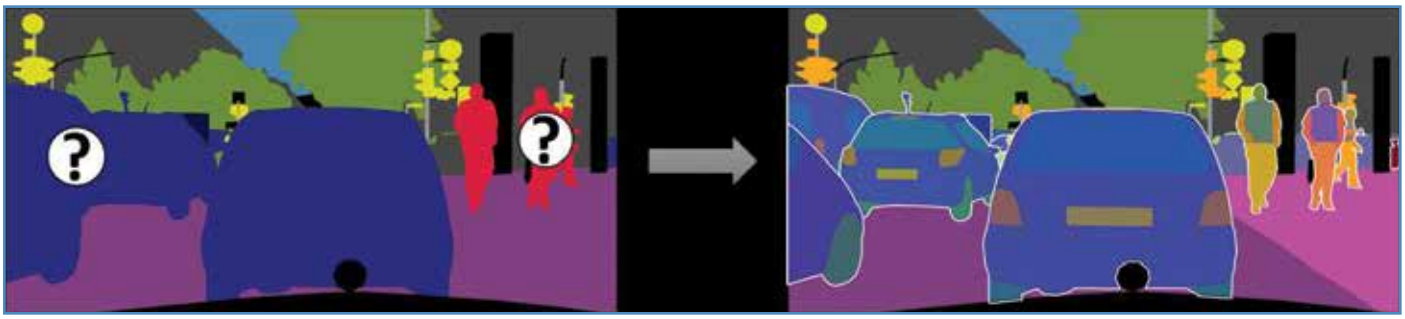


Figure 3. Differences between a poor description and a holistic understanding of a scene. The system which generated the left description doesn't distinguish different cars and doesn't recognize human parts. Our system on the right distinguishes objects by white contours and recognizes various parts of objects.

Holistic street scene understanding

Apart from accurate scene understanding, automated driving requires a holistic analysis of the traffic scene (see Figure 3). Imagine a human driver who doesn't recognize a very specific traffic sign or doesn't distinguish an animal that jumps in the road. His decisions might not be correct, leading to an accident. Similarly, the CNN should be able to recognize a large variety of everyday concepts, also called semantics. For example, they should recognize hundreds of traffic signs and dozens of vehicle types in order to take accurate decisions. Another example is the recognition of human or vehicle parts, like limbs or lights, as these give important clues for future anticipation. We have quadrupled the number of recognizable semantics by a single CNN achieving all-encompassing street scene understanding.

In conclusion

The universal applicability of fully-automated driving depends on many aspects and requires societal, legal, and technological breakthroughs. Although progress has been made in all of these aspects, there is still a long way to go for witnessing fully-automated driving on every single road on the planet. Our ally for accelerating this endeavor is artificial intelligence. Latest advances in AI have enabled automated cars to understand their surroundings in order to perform safer actions. Our contributions offer more accurate and detailed scene understanding in a variety of environments, and provide a rich description of a street scene involving more semantic concepts than before. We envision that these contributions will accelerate the adoption of AI for street scene understanding and enhance driving automation in the near future. ■

Figure 4. From the back seat of the car, the passenger can view the segmented image - such as the car's cameras see the world - in real-time. This also allows passengers to get a better understanding of the car..

In memoriam: prof.dr.ir. J.E.W. (Jan) Beneken

By: Various authors

Jan Beneken was dean of the Electrical Engineering department at Eindhoven University of Technology (TU/e) and one of the pioneers of medical research and education at TU/e.

He obtained his M.Sc. degree in Electrical Engineering at Delft University of Technology in 1958. His MSc thesis project was carried out at the Medical Physics Institute of T.N.O (MFI), where he was subsequently employed. His PhD work was done under supervision of Prof. H.C. Burger at the Department of Mathematics and Natural Sciences of Utrecht University and finalized in 1965. The title of his dissertation was 'A mathematical approach to cardiovascular function. The uncontrolled human system'. This work formed the foundation of a lifelong dedication to scientific work in modeling and simulation of physiological systems. During his Ph.D. research, he already was appointed head of the division of Cardiovascular Physics at the MFI.

Having obtained his Ph.D., Beneken spent several periods at well-known scientific institutes in the USA such as the University of Mississippi Dept. of Physiology and Biophysics where he collaborated with renowned scientists such as dr. A.C. Guyton, author of the standard Textbook of Medical Physiology.

In 1973 Jan Beneken was appointed as the first full-time professor in Medical Electrical Engineering at TU/e. He continued to combine groundbreaking scientific work in physiological modelling and simulation with strengthening the international scientific community on Biomedical Engineering. He was one of the founding fathers of the multi-departmental TU/e Institute for Biomedical and Healthcare Technology (BMGT). In 1980 the Medical Electrical Engineering group was established at TU/e with Beneken at the helm. From 1993 until his retirement in 1995 he also served as Dean of the department of Electrical Engineering.

Between 1984 and 2000 Beneken was visiting professor at the Department of Anesthesiology of the University of Florida College of Medicine in Gainesville, Fl. Together with one of the international pioneers in Patient Monitoring, Prof. Nick Gravenstein senior, and a multidisciplinary team, Beneken laid the foundation for a range of physiological patient simulators that allowed anesthesiologists to get acquainted during training sessions with common as well as rare situations that may occur in patients. For this and his other scientific accomplishments Beneken received a Distinguished Achievement Award at the University of Florida.

Jan Beneken was chairman of the advisory committee for the 4th European Medical and Health Research Programme (MHR4) from 1987 to 1991. He was appreciated internationally for playing a crucial role in promoting European research and multi-center collaborations in Engineering and Medicine.

The methods and strategies for modeling of human physiological systems that Beneken and coworkers have developed over the years have proved to be applicable in a wide range of clinical areas, such as anesthesia, high care, and delivery. In recognition of this legacy and of Beneken's eminent stature, the international 'Jan Beneken Conference on Modeling and Simulation of Human Physiology' was established in 2013 and has since become a successful biannual event.

We are grateful for Jan's pioneering work in setting up and developing research and education in Medical Engineering at our University and abroad.

Pierre Cluitmans, Jan Bergmans, Bart Smolders ■

In RetrospecThor

By: Pieter van den Boom

At Thor, a board of the association is usually referred to by their board number, ranging from the 1st board at foundation, up until the current 65th board. In the last few Connecthor issues, we've been closing in on 'recent' board years. Just like last issue, we've asked a member of the board matching to the issue number to look back at their time at Thor. What has this former board member done at Thor? Has being an active member been a benefit to life after Thor?

For this 56th issue, Pieter van den Boom, Vice-President and Commissioner of Education of the 56th Board of e.t.s.v. Thor, has written about his experiences.

My time at Thor is a time I will never forget. I learned a lot, got to know a lot of people, was pushed to my limits, and enjoyed the support of my fellow Thor members whenever it became too much. All in all, it were eight hectic but satisfying years. However, one of these years transcends them all: the academic year in which me and my fellow Board members got to call ourselves the Board of e.t.s.v. Thor.

Board year

During that year, all of the aspects of being a Thor member were heightened. Starting with the introduction week as a candidate Board member, I got to know a lot of freshmen and pushed my body to its limits. I remember barely being able to wipe my back dry after the first day, and then there were still 4 days of activities and partying to go. After that, our time as candidate Board came to an end. After the Board change, we became responsible for the comings and goings of the association. In the beginning, it was a lot to get used to and we were not very efficient in performing our tasks. When we eventually started to get the hang of it, the Lustrum festivities started. As Board, we were expected to partake in as many activities as possible, and as a result we still struggled to perform our tasks within the time that was available to us.

After the lustrum had passed, we gradually got more time to spend time on our Board policy. Since already nearly half the year had passed, we had to prioritize on what to and what not to do. One of these policies was to get the Automotive students involved with Thor. The Automotive study track was new at the Department of Electrical Engineering and the students did not identify themselves with Thor, despite Thor being their study association. Besides organizing activities like go-karting and excursions to automotive companies, we also organized the AU-Tech study trip to Germany, which was, unsurprisingly, focussed on automotive. With 23 students from both Automotive and Electrical Engineering we ventured into Germany, visited several automotive manufacturers and also visited the Porsche and Mercedes museums in Stuttgart.

Our Board year was also the year in which the Bachelor College was introduced. As can be expected with every change, not everything went according to plan. As the Commissioner of Education, I was tasked with guiding the feedback from the students through the appropriate channels. I particularly remember that during the first year, the Electrical Engineering students were particularly displeased with the User, Society and Enterprise course (better known as USE). To improve the course for years to come, I brought some students in contact with the course supervisor, so he could hear the feedback first-hand and interact with the students on how to improve the course for the years to come.

All in all, a very busy year, but also a year to look back to with great pride. A year where we celebrated the ups with the entire association, but also a year in which we got support from the association when we were down.

Convincing

Before you start you start participating in one of the larger committees Thor has to offer or even a Board year, one of the hurdles to overcome is to convince yourself and your parents that it is worth the time and effort you put in it. Most often convincing yourself is easy. You hear about the experience from others and know that is what you want to do.

However, convincing your parents usually is a bit more difficult. Sometimes they are convinced by your puppy eyes, but not rarely they need to be convinced with proper arguments. Looking back, it is easy to list these arguments. However, when I wanted to become a Board member, I did not know where to start. Hopefully my story can help you convince yourself, but not in the last place your parents.

Thor after the TU/e

Even before completing my studies, the first benefit of being an active Thor member after my life at the TU/e became apparent. During a conversation in Het Walhalla, I got into conversation with an old friend who I hadn't seen for I while. I dropped that I was looking for a job and when he told me about his work, I got interested. Two weeks later I had my first interview and a month later I signed my first contract, even before finishing my studies.

Three years later and still working at the same company, I can say that my experiences at Thor have helped me a lot during my professional career. One example is the flexibility you are taught by organizing activities at Thor. During those activities, not everything goes according to plan, which incites the need to 'Thorganize'. That is exclusive to Thor, but also in your professional career you will encounter situations in which you need to be flexible and act quickly.

One such situation is when a customer experiences a disturbance in a critical process. When that happens during night time, I need to make sure the customer can resume production with minimal impact from the disturbance, so that I or one of my colleagues can have a better look at the problem the next morning.

Another I recently experienced is the current shortage of components in various industries. Our team came to realize that the lead times of some critical components for the testing setup were up to six months. Since the project is due to finish in four months, we were forced to think in alternatives. Fortunately, we've got some old testing setups which are ready to be decommissioned. Using these components, we are able to not only build together the setup in time, but also to reduce the costs of the setup drastically.

But not only in your professional life you experience benefits from extracurricular activities after your studies. One other aspect of being active at Thor is that you learn to engage with other people.

One example comes from the fact that I regularly partake in organizing events for different clubs and societies. When organizing those events, I regularly catch myself going up to attendees and asking them on their experiences during the event. Somehow, I'm still gathering feedback. This time not for courses at the TU/e, but now for events in my home village.

Concluding

In this article I gave you a short insight in my time at Thor. I also enumerated some benefits I had from that time after my studies, but let me assure you that that list is far from complete. If you want to know more about my time at Thor or the benefits of extracurricular activities after your time at the TU/e, don't hesitate to approach me whenever I'm around, usually at Het Walhalla.

I hope you enjoyed reading my story about my time as a Thor member and the lessons I've learned from that. It would be nice if I was able to convince you to become active at Thor or take up some other extracurricular activity (take a good look around, Eindhoven has a lot to offer!). If you are properly convinced yourself it is worth the time and the effort, you should have no problems convincing your parents. ■

Name: Pieter van den Boom

Current Job: Software Developer at KSE Process Technology

Studied EE: 2010 - 2018

Activities at Thor: Too many to mention, but amongst others: BuEx, ReisCo, CoCo and Aegir.

Other: I'm also rooted in my home village, where I also participate in different committees and am currently part of the board of the carnaval association.

Can you solve tomorrow's engineering challenges with AI?

Engineering challenges are becoming more and more complex. Systems should be more accurate, work in dynamic environments, be more intelligent and cooperate seemingly with other systems. VBTI helps customers with these challenges by combining solid engineering tools with the latest AI technology. Our deep learning solutions already had a big impact on the products of our customers in areas including agriculture, manufacturing and tele-communication.

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About

VBTI was founded in 2019 to help companies adopt AI technology. Its founder dr.ir. Albert van Breemen has 30+ years of experience in Artificial Intelligence and high tech industry. Currently, the VBTI team consists of 11 employees and students and we are located in Eindhoven.

VBTI

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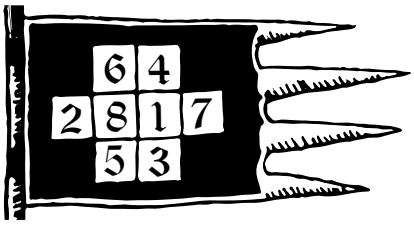
Previous puzzles

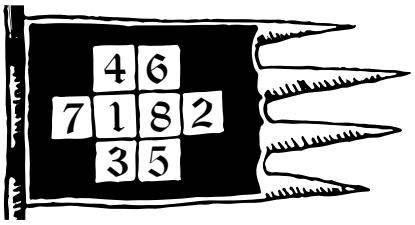
Answer and winner of the September puzzle

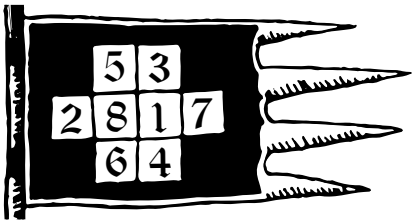
The answers of the September puzzle can be seen on the right. As some of you pointed out, there are indeed multiple solutions to this, all mirrored versions over the horizontal and vertical axis are possible as well!

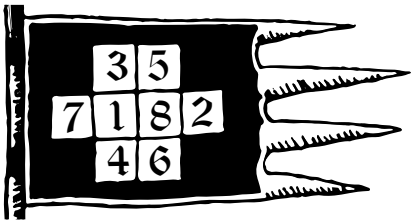
The winner of this puzzle is Stefan Geelen! Congratulations Stefan!

A long wait can often definitely pay off, as was the case for the winners of the previous December, March, and June editions, who finally got their pie!





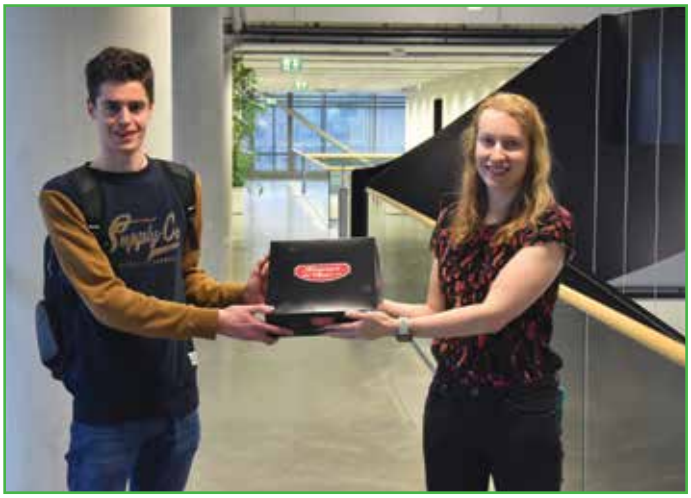




Maarten van Rossum getting the pie he still had from winning the puzzle of the December 2020 edition.

Marjolijn Kleijer receiving her prize pie from winning the March 2021 edition puzzle.

Valerie Tjin-A-Djie getting the pie she won from winning the June 2021 edition puzzle.



Stefan Geelen getting the pie he won from the puzzle of our previous edition.

Puzzle

New puzzle
In the puzzle on the right you can see a sum consisting of nine different letters. You have to swap each of these letters for a digit between 0 and 9 in such a way that the sum is valid.

You are allowed to use each digit only once! Therefore only one digit will not be used.

Don't forget to send in the answer to connecthor@thor.edu at the 30th of January 2022 at the latest if you want to have a chance at winning a pie!

Good luck!

Join the Connecthor team
The Connecthor team is looking for new members. Are you interested in helping us create this magazine? Then join us! Do you think that the Connecthor can be improved? Then prove it to us by joining us! Everybody from the department is welcome.

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When will you die?

By: Tom van Nunen

Drinking a bottle of red wine, riding your bike for an hour, eating forty peanut butter sandwiches, taking an x-ray photo, and traveling ten thousand kilometers by train; what do these things have in common?

Each of them are associated with the same risk of death: a chance of one in a million, to be precise.

Ronald Howard was a teacher and researcher in the field of decision analysis at Stanford University. He was particularly interested in the influence of very small probabilities on very large populations. In 1968, he introduced the unit micromort, a one in a million chance of dying, just as a micrometer is one millionth of a meter.

Of the examples mentioned above, the underlying mechanisms that cause the risk might be different, yet using the micromort unit, they can still be compared quantitatively.

There are of course activities that carry a much greater risk, for example: scuba diving (trained)(5 micromorts), running a marathon (7), sky diving (8-10), first day of life (430), and ascending Mt. Everest (37932).

For you and me, a chance of one in a million is about the same chance as throwing a dice to hit six eight times in a row, or to flip a coin and hit head twenty times in a row. Not that much impact, right? So, what can we these numbers be used for?

These numbers become interesting when applied to large populations, as mentioned before. They can be used to define policy of governments or insurance companies. Spectacular differences quickly become visible. When we compare the risk of traveling one hundred kilometer on average, we see that the train (0.01) and airplane (0.06) are safer than the car (0.3), and that the bicycle (3), walking (4), and motorcycle (12) carry a far greater risk.

Of course, some remarks have to be made: not many people walk one hundred kilometers on a single day, and the risk of flying is mainly focused around the departure and landing. Nonetheless, on average, these numbers can give a great insight.

The micromort unit can be used to measure acute risks, i.e. immediate death. It is however less applicable to chronic risks, which reduce the life expectancy. For example: smoking will not kill you instantly, but will affect your life in the long run. To measure those risks, the term microlife was introduced: a one millionth reduction in life expectancy. This corresponds to roughly half an hour. It turns out that, for small risks, the change in life expectancy is about linear.

Examples of these risks are: watching television for one hour (-0.5 microlife), having a BMI above 22.5, per unit of BMI per day (-0.6), eating a portion of red meat (-1), eating a portion of fruit and vegetables (+0.8), and the first twenty minutes of moderate exercise (+2). As you can see, this unit can also be used to quantify the effect of things that are beneficial for your life expectancy.

During the vaccination campaign for COVID-19, much attention was given to the few people who unfortunately died after receiving the vaccine. For some people, each death was received as solid proof that the vaccine would be bad for you. The work of Howard is well suited for quantifying the risks associated with a COVID-19 infection, and those associated with getting vaccinated. Maybe the antivax community can have a look at the science. They might realize that going out the door at morning poses a far greater risk than taking the jab.

This column was inspired by an article from Robbert Dijkgraaf in NRC, 2013 ■


Happy holidays!