connecthor

In **RetrospecThor**

Technology and **John Dewey**

A student's **photonics** journey

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September 2021

|EDITORIAL

Welcome back to the Campus. Many of us have come back to the office after the summer break, but with the new less rigid government rules, campus life has become more like the one we knew from two years ago. It gives us the much needed inspiration to start a new academic year.

This year we celebrate our 65th anniversary. Which means that in the weekend of October 15, 16 and 17, 2021 we will be treated to a long weekend of the "Heroes Like You" Festival. Program can be found on the TU/e website.

It gives us great pleasure to present this Connecthor to you. Within this edition you will find a word of welcome to our new students from our Program Director/Vice-dean Education, Marion Matters-Kammerer. And as you might have expected, the new candidate board members of Thor introduce themselves to you too.

Furthermore, you will see all the festivities around the introduction weeks for our new students. It has been so much fun to see the students be able to come to the campus and get to know each other face to face instead of via cameras.

We have two PhD articles to show the cool and marvelous research we do within our department. There is a lot to read. Enjoy reading this new edition of the Connecthor!

The Connecthor editorial board ■

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In RetrospecThor
How does being active during your study benefit your future carrere choices? Read about Elles and Manon's experiences on page 30.

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Introductionweek 2021
Read more about the introduction week on page 26 and check out the photo's on page 12 till 18!
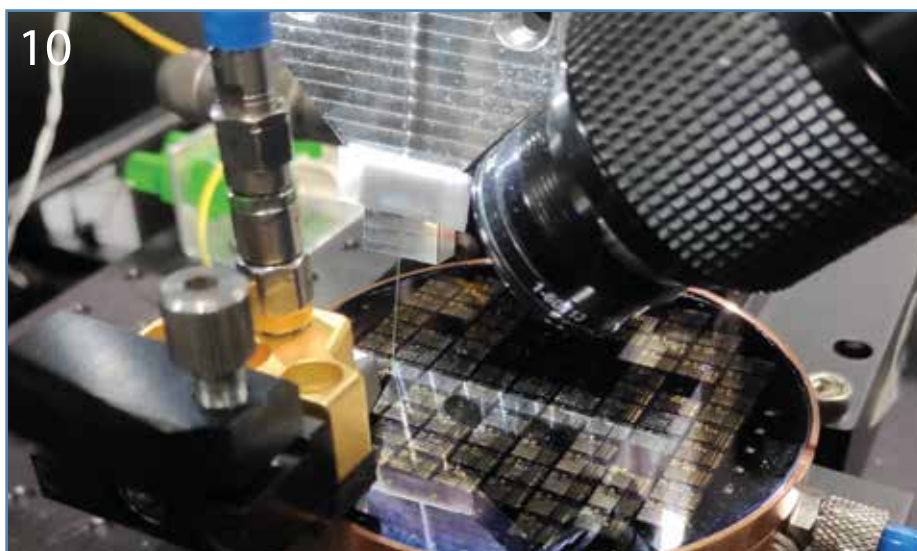
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A student's journey from electrons to photons
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Board issues

By: Bart Smolders

About 10 years ago, in September 2011, I was very fortunate to do a mini sabbatical at the National University of Singapore (NUS). At that time, I had two main reasons to visit the NUS. Firstly, the Bachelor success rate in the Electrical Engineering (EE) Department is extremely high, with about 80% of the students completing the EE bachelor's degree within the stipulated period. Only five percent drops out in the first year. Secondly, the NUS receives a relatively large cohort of new students each year (about 600 freshman). At that time in 2011, our department had an influx of about 65 new students in the Bachelor program with a drop-out rate close to 50%.

In the past 10 years, we made a huge effort to improve these numbers, and with success, although we again need to work on our curriculum, and we need to polish our outreach activities towards future students. However, we could and cannot match the study success rates of NUS, since our students take way more time to finish their bachelor's degree. We will try to improve, but I believe we need to accept that we will never come close to the 80% rate of students completing the bachelor in three years.

Regarding the influx of new bachelor students, we are doing pretty well, and we again expect about 250 freshman this academic year. This is slightly higher than in the past years, mainly due to a strong increase in the number of international students from Europe (so called EEA countries). The number of Dutch students is decreasing over the years, from 180 in 2018 to about 120 in 2021. This drop is partly due to regional developments in Limburg and the eastern part of Brabant, where the number of VWO students is dropping fast. This is a trend that is observed in all study programs at TU/e. In order to maintain the current size of our department, this will imply that the ratio of Dutch versus international students will change rapidly. In my view, a 50-50% ratio would be ideal, since it will truly create an international experience for our students with a strong Dutch engineering flavor.

To maintain a solid influx of Dutch students we need to further improve our outreach activities. In the past months ,we already started to work on this with several of our young staff members and students. We are developing new videos and supporting material, like presentations and demonstrations for the open days. Your help is also very much appreciated here, please contact me if you have ideas and/or are willing to participate in outreach activities. In my experience it is fun to do.

Please do not hesitate to contact me personally if you have a question or suggestion related to this topic.

Bart Smolders, a.b.smolders@tue.nl ∎

From the President

By: Jurgen Kok

Exactly four editions ago, Sanne wrote her last item for this column. This means this is also my fourth and last contribution to this rubric. In these 9 months, a lot has changed. At the time I am writing this piece for example, I am sitting in a really busy Board room with my complete Board and some candidate Board members. That is a huge contrast with the moment I wrote my contribution to the March edition, when we were only allowed to sit here with one other person. Frankly, it was much easier then to concentrate on writing, however, it is much more 'gezellig' right now!

This is just one of the changes that have taken place over the past year. And there are quite some more to come. More than one and a half years ago, when I started the complete track to become a Board member, they already told me a lot would change during a Board year. They of course did not mean to predict the corona crisis we have gone through over the past one and a half years, but this message still says it all: Doing other things and living in another environment changes things. To you and to the world around you.

That's the reason why people always tell you to change your environment from time to time, it being a small change by just moving some stuff around in your room, or more substantial changes as changing jobs or functions. I kind of chose for a mixture of both, whilst writing this piece. As the inspiration and motivation was quickly draining, I decided to put the writing on hold for a few days and these few days quickly evolved to two weeks. This however forced me to change my environment. I am currently in another place at floor 6, still looking at the place where I started writing, but now, a new generation and a future President is sitting on the exact place I sat two weeks ago. One thing didn't change, I am still struggling to concentrate, but in a whole other atmosphere, which made me realize the Board room isn't that noisy after all!

This change didn't bring me just one thing, namely a whole new paragraph for this piece, but it entails much more than that. It kind of symbolises the changes you can go through in 20 months. 20 months ago, I was on this exact place. I just subscribed for the Board interest lunch and I was staring into the Board room. Still too shy to join the scary old people at the counter, but maybe already looking forward to a possible Board year.

As I am sitting right here, I notice a lot has changed since then. I've met a lot of new people, learned a lot of new skills and changed my approach to almost everything, even to studying, although this change is not for the better. All this change was just caused by the single choice 600 days ago to subscribe for a Board interest lunch. Of course, such a choice is not made overnight. A simple press of a button might still be the beginning of something new. Think of your subscription for your study as a high school student, the moment you applied for your job or just the simple subscription to your first Thor activity. In the end, you can break them apart in decisions as small as just a simple click, a single 'yes' or a short 'no'. There are loads of options and buttons in your life, and you will only ever realise what's behind them if you press them. I clicked on 'subscribe' once, and it turned out to be an adventure called a Board year which I will never forget.

Veel gedonder!

Jurgen Kok
President of e.t.s.v. Thor ■

Welcome!

By: Marion Matters

A new start for the first year students, and a coming back for all other students and staff. We sincerely hope that this study year will bring us all back to the campus with the interaction that is key for academic learning and research.

Starting a new study is a key step in your life and it will remain a corner stone for your future career. The number of students has increased this year mainly due to the increased number of international students in the bachelor. For you, a special welcome to The Netherlands and to Eindhoven. We very much hope you will feel at home here quickly. For all our students: Enjoy your study, experience academic life, and find new friends.

Our teaching staff has worked tremendously hard to enable high quality teaching also during the Covid time. New teaching styles have been tried out that work online, hybrid and on-campus. It is impressive to see how fast this has been realized and how much dedication was put into it! During the last year, many new staff members have joined our department and we are very much looking forward to meeting all of you in our Flux building after so many online meetings.

Two developments I want to highlight on the educational program. First, Artificial Intelligence is becoming a very important topic in the department and the university. Education at TU/e is developing quickly in this area as well. Our master track on Artificial Intelligence Engineering Systems (AIES) will become a full master program with an intended launch in the study year 2022/2023. Secondly, a key asset of our department are the high quality labs. Also this year we will further invest into our educational labs, among others in challenge-based learning, which embeds the learning goals of our program into academic, societal and industrial challenges.

Excellence and curiosity is inherent to academic teaching and learning. Through the Honors program for bachelor and master students, the NXP scholarship program for millimeter-wave technology, the Photonic fast career track, and the participation in student teams you can develop talents beyond the regular study program.

Our PhD program is the largest PhD program of the university with many contacts at national and international level to academia as well as to industry. Last year we have established the PhD-PDEng council in the department

as a better representation of the PDEng trainees and PhD students in all groups of the department. In this way, we strive towards a stronger feedback loop and more interaction between the PhD students and PDEng trainess in different groups. The Covid time has taught us more than ever, that the well-being of our students and staff members is of utmost importance as well as a safe work and study climate. There is always room for improvement in these areas and my door is open for conversations about these topics.

With this message I want to encourage you to meet each other, find new friends, create and experience the atmosphere at the department, the university and the Brainport. Join the activities of the numerous associations, especially also of the study association Thor at our department. Realize your dreams, be ambitious, strive for excellence! Keep in mind the high responsibility we all have towards the people and the world around us - contribute with your ideas, knowledge and ambition!

Hope to meet many of you in the new study year!

Marion Matters, Vice-dean Education ■

Introducing...

Hi everyone! My name is Pourya Gohari Nazari, and I've recently joined the Electronic Systems (ES) group as a PhD-student. I come from the beautiful country of Iran. I earned a bachelor's degree in computer engineering from the University of Isfahan, Iran. Then, I received my master's degree in computer systems architecture from the Sharif University of Technology in Tehran, Iran. During my master's degree, I have conducted research on several different topics including real-time systems, reliability, and resource management.

My project focuses on designing analyzable machine-learning-based scheduling for real-time systems (in automotive, high-tech systems, and health application areas).

My hobbies and interests are graphic design, reading books, watching movies, biking, and working on my personal projects.

I am excited to start a new chapter in my life in the Netherlands and I'm sure that working at the Eindhoven University of Technology will be a great experience for me.

Looking forward to meeting new colleagues at the TU/e! ▪

Hello, my name is Salim ABDI, and I am from Algeria. I recently joined the Photonics Integration group as a PhD student to work on the TWILIGHT project. I hold a bachelors in materials science from Ecole Nationale Polytechnique - Algeria, and a research master's in physics from Polytechnique Montreal - Canada. During my master's, I worked on the fabrication and characterization of ohmic contacts on a novel semiconductors system. I was able to characterize epitaxial doped and undoped layers, and also apply a novel laser annealing process for low thermal budget functionalization of Ni-based ohmic contacts. I really enjoyed my research journey during my master's, which is why I wanted to extend my stay in academia and apply for a PhD. The ongoing project we are working on is very exciting, it is related to building high-speed next generation transceivers by co-integrating InP high speed electronics and photonics using the IMOS platform. I would also love to help with any questions based on my previous experience, so please do reach out to me. As for non-academic activities, I really love the outdoors like hiking and kayaking, I got to do that in Canada, and I look forward in doing it in the Netherlands too. Finally, I hope to get to see and interact with most of you during the course of my PhD. ▪

Hello everyone! My name is Yihui Wei, and in May 2021 I joined the Photonic Integration group as a PhD candidate. I'm from China, and received my bachelor's and master's degrees in Optical Engineering from a Chinese university. Both my MSc and BSc theses were focused on the research of silicon photonic devices based on multimode approach. Curious about the research and the life style in other places, I decided to leave my comfort zone and go abroad, seeking for further vision and potentials.

Now I am working within the framework of the European-funded INSPIRE project, which aims to revolutionize photonic integrated circuit technology by combining Indium Phosphide (InP) and Silicon Nitride (SiN) photonics in a single platform. Wafer scale coverage of InP devices on SiN circuits will be enabled, using innovative hybrid building blocks and printing methods. Within this context, my PhD project will center on the development of InP building blocks and coupons for transfer printing for hybrid integrated photonics.

In my spare time I like listening to music, singing, watching movies, and traveling to discover new places. I'm not a sports fan, although I enjoy practicing yoga, spending time in the nature and going hiking. I look forward to meeting new friends at TU/e. ▪

Master Graduates

Congratulations to all the Graduates who received their Masters degree on June 22nd 14:30.

Bertram, E.S. (Erik Sebastiaan); Cai, C. (Chuchen); Cornelissen, S. (Stefan); Erp, B. van (Bart); Graaf, J.P. de (Jasper Pieter); Hof, D. van den (Daan); Hooimeijer, B.J. (Bram Joppe); Kloosterman, R.J. (Rob); Kok, M. de (Martijn); Manev, V.G. (Veselin); Megen, E.L.C.E. van (Edgar Laurens Christof Evarice); Coenen, S.L. (Sebastiaan Laurens); Mihaylov, N.I. (Nikolay Ivanov)

Congratulations to all the Graduates who received their Masters degree on June 22nd 16:00

Oort, M.A. van (Matthijs Andreas); Puts, L. (Lukas); Ratin, A.S.R. (Arafat S R); Samulski, Ł.M. (Łukasz Marek); Steinebach, L. (Loek); Tong, A. (Anni); Uyar, F.Ö. (Fahrettin Ömer); Venkateswaran, R.B. (Rogith Balaji); Vorst, D.M.N. Van de (Dennis Maikel Nando); Ye, C. (ChangQing); Zdravkova, I.P. (Ilina Plamenova); Leeuwen, M.C. (Martin Christiaan)

Congratulations to all the Graduates who received their Masters degree on June 29nd 12:00 and 14:00.

Borsboom, J.J. (Jelte Jolan); Tops, B. (Bart); Loosdrecht, F.A. van (Freddie); Bosch, A.E.C. van den (Alain); Timmerman, N.A.G. (Niels); Eshof, F.R. van den (Frank Robert); Bruijn, J.G.C. De (Joël Guy Corneille); Bastiaansen, A.R.N.M. (Thomas); Legters, M.J.W. (Mark); Westbeek, J. (Jelle)

A student's journey from electrons to photons

By: Jasper de Graaf

The magical behavior of electronics made me decide to move to Eindhoven to study Electrical Engineering, as I was really eager to learn how all of these components and devices actually work. During my adventure as a student, I stumbled upon the even more magical field of Integrated Photonics. I'll go over my personal experience with this amazing field, and hopefully show some very interesting details in a world you might not be very familiar with yet.

A spark of magic

My personal interest in Electrical Engineering really took off during a physics project in the 2nd year of high school. I was truly fascinated by how combining electrical components somehow resulted in a functional product, almost as if it was magic! Although the project was fairly simple using components like switches and LEDs on a custom made wooden 'breadboard' where pushpins and copper wire were used as connections, the magical behavior of electricity was demonstrated perfectly.

Electrical Engineering as a Bachelor student

During my bachelor at the TU/e, I discovered so many other aspects of Electrical Engineering that I did not know existed before. I can imagine this is something a lot of students can relate to. And for sure, the bachelor track was quite different compared to this high school physics project, but the magic of electrical circuits remained. Learning more about the physics behind this magic was (and is) a great journey for me and working on the edge of state-of-the-art technology keeps this magic somewhat in place.

From electrons to photons

One of the EE electives in the bachelor is the course Photonics, which, to be fair, was a bit of an outlier compared to the other EE electives. Although the topics of the course are most certainly linked to many of the topics in EE, it was not something I thought of doing when I decided to go for Electrical Engineering. I was however pleasantly surprised by the course, as the topics again raised the 'magic' bar to a new level. The electro-optical components such as lasers and photodetectors, in combination with all the passive optical components allow to generate, guide, manipulate and detect light. Also, the fact that there is still so much to discover within the photonic integrated world really sparked my interest.

My first photonic integrated circuit

At the final stage of your bachelor, you get the opportunity to pick a final bachelor project. I simply browsed around on the final bachelor project marketplace where all available projects can be viewed and stumbled upon a Photonic Integration project where the goal was to design, fabricate (by a PhD student) and characterize a waveguide crossing. The project was within the in-house novel integration platform called Indium-Phosphide membrane on Silicon (IMOS) (Fig. 1) which is evolving into a generic photonic integration platform where designers can use pre-defined building blocks to generate photonic integrated circuits. One missing element at that
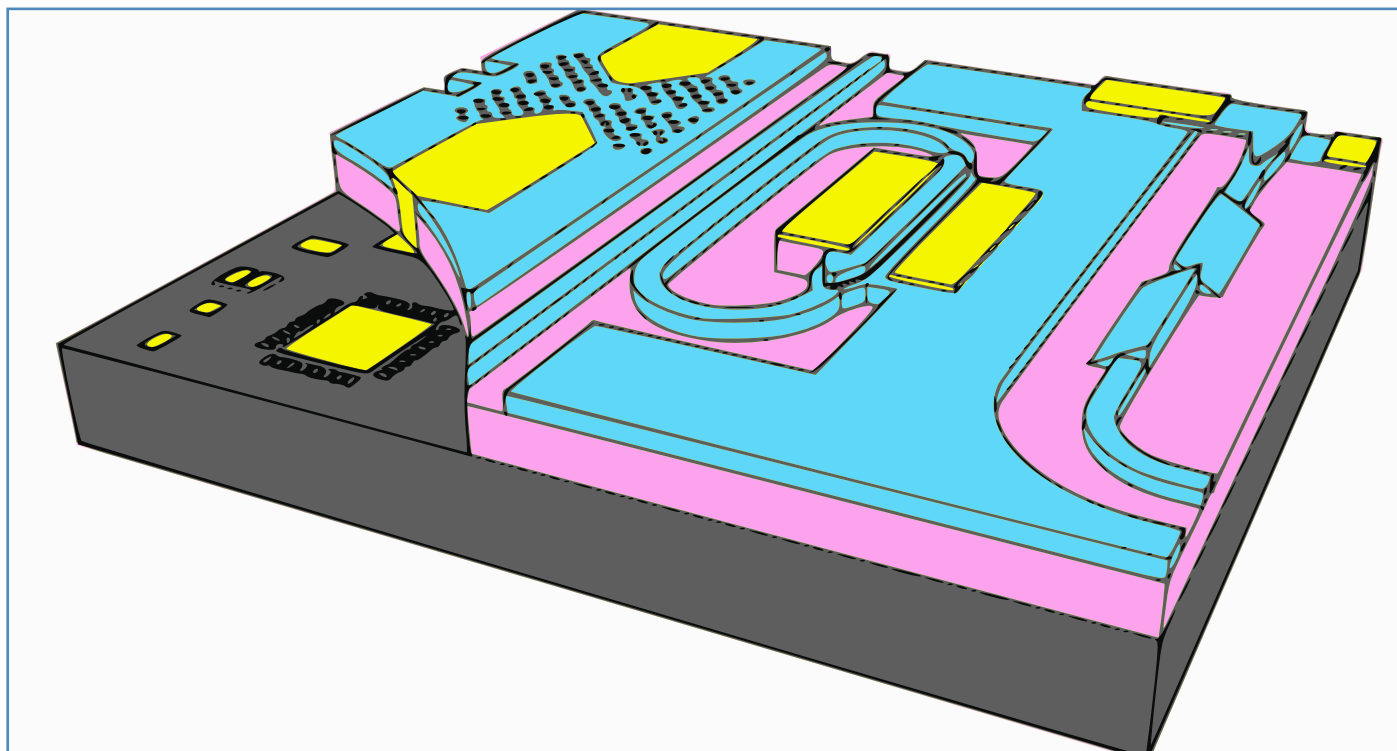

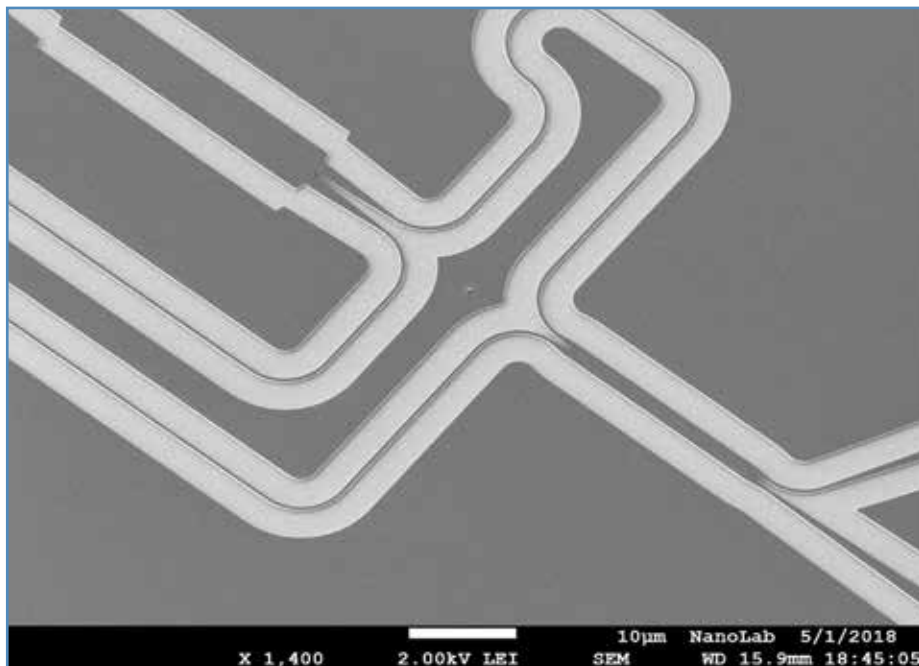*Figure 1: A schematic representation of the IMOS technology*

Figure 2: A SEM picture of the waveguide crossing in a characterization circuit

and could see transmission through fifty cascaded waveguide crossings of my own design was an incredible moment!

A tiny swimming pool filled with light

The design of the waveguide crossing is based around an effect called multi-mode interference and works similar to how you can generate an interference pattern in a square swimming pool by causing waves using two balls separated by some distance. The ability to make use of the wave-like behavior of light in an area as small as 20x2 µm2 and using this to design a photonic integrated device to be used as standard building block was again some of this magic that keeps me motivated to continue learning within Electrical Engineering.

My FBP was merely the start of a journey within photonic integration, where I also did my masters and where I am now pursuing the PhD title. The main thing I want to point out with my story is that within Electrical Engineering, there are many interesting research areas, from some of which you might not even know existed. Try to get a sense of as much of the areas as possible and go for the direction where you think you can learn new interesting concepts while also maintaining some of that magic.' ∎

time was a crossing for the main way of connecting integrated optical devices, being the waveguides.

This project was an amazing journey, as I was able to get familiar with the theory and state of the art, come up with a design based on first order approximations, verify the design using finite-difference time domain simulation software and design circuits suitable to characterize the crossings. Within the timeframe of the project, my designs were fabricated in the NanoLab cleanroom at TU/e by my FBP supervisor (Fig. 2) and I was able to perform the measurements in the characterization lab in Flux (Fig. 3). The first time I aligned the optical fibers from the measurement setup to the optical chip

Figure 3: Measurement of a photonic integrated circuit on a full IMOS wafer

The various introduction week groups

With the introductionweek behind us and with the start of the new academic year, here are once again all the new students with their respective groupmembers during the Bachelor introduction week.

The editorial team of the Connecthor wishes everyone goodluck with their studies.

1 till 6. Bachelor Introduction

7. Lunch Lecture Deerns

8. 255th GMM

9. First DaTUes

10. Monthly lunch June

11. Tappersopdracht Jasper

12. Tappersopdracht Nick

Introducing the candidate board

By: Various authors

Hello everyone, my name is Mart Philipsen and I am the candidate President. During the intro, I quickly found out Thor was an amazing association. Because of this, I decided to join Ivaldi, as with all my fellow candidate Board members. Together with my subgroup, we were planning to organize the 'Elementary Schoolympics', but this was sadly canceled due to corona. Fortunately, I still managed to organize many fun activities in my second year at the ACCI, such as the ACCI Game

My name is Bas van Steenbergen and I am the candidate Treasurer. In my free time, I love to go downhill mountain biking in Germany with some of my mates. During these trips, we like to take as many other Thor members with us to let them experience the thrills of downhilling. My Thor career started, as so many, with Ivaldi. Like a lot of people, I joined Ivaldi after my ThEW and there I started to become an active member. In the Ivaldi, I organized the Open House Day, where my parents visited the campus and Het Walhalla, as

Show 1 and 2, the Wild Wild Flux murder mystery, and some other small ones. In my free time, I like to play volleyball here in Eindhoven at Tamar, but on the weekends, you can find me and Koen, our candidate Commissioner of External Affairs, back home in Lochem in our woodworking shed making electric guitars and basses. Now that the "borrels" have started again, I hope to see you soon at Het Walhalla for a drink (or two)!

Geen gedonder! ■

Hi everyone, I am Isabel van Gog and I am the candidate Secretary. After an amazing intro, I was really looking forward to my student time within Thor. This all began with me joining the Ivaldi, where I was trying to organize my first activity. Due to the upcoming corona measures we, unfortunately, did not get to do the activity, but that gave me all the more reason to slide right into the ACCI. After only two weeks, we already put a pub quiz together and after that, many other cool activities. Later in my second year,

well as a dropping. This year, I am in the ACCI, where I organized two editions of the ACCI dance event and an old-school Dutch kids birthday party, the TACo, where we will build the next beer car of the association, and Aegir, where we normally organize the big Thor parties on Stratumseind, which sadly due to corona is inactive. And of course, like everyone else, I enjoy spending time with my friends.

Geen gedonder! ■

Hello everyone, my name is Thor Abegg and I am the candidate Vice-President. At the start of my first year, I decided to join Ivaldi in which I found out how much I like being active at Thor. Therefore I decided to join the ACCI in which I was able to organize many great activities, despite most of them being online. Furthermore, I joined the TACo where we built the draft car for the introduction week.

I joined the LuBo, where we are working on the next Lustrum Book. I am also part of Aegir, and when corona is over we will definitely organize an awesome party again. In my free time, I like making music on my piano or guitar or spending time in Het Walhalla with my friends. I'm really looking forward to next year and I think we will all make some great memories together.

Geen gedonder! ■

In my free time, I like to go for a run or watch some sports. That's one of the reasons that I decided to get a season ticket at Ajax a few years ago. Next to that I also have a big passion for music. That is why together with a few fellow active members I will be setting up a DJ committee next year. I hope to see you all on floor 6 or at a drink.

Geen gedonder! ■

Hi everyone, my name is Esther Maas and I am the candidate Commissioner of Education. I am 20 years old and grew up in Raamsdonksveer. I have always wanted to study in Eindhoven and moved to the city as soon as I started studying here. Like many other Thor members, I started being active in Thor with Ivaldi. After a year of fun activities and many 'vlaaien', I was so excited about Thor that in my second year, I decided to join the ACCI and the Lubo, the yearbook committee.

My biggest hobby is cooking. My favorite types of dishes to make are from the Thai or Indonesian cuisine. My passion for cooking inspired me to join the FoodCo, where I help to organize tasty barbecues, hot cocoa drinks, and many more fun activities. The past two years have been so fun and I have learned so much, that I decided to spend my next year as a Board member. I am looking forward to seeing you all in Het Walhalla!

Geen gedonder! ◼

Hi, my name is Britt Vermeulen and I am the candidate Commissioner of Het Walhalla and Commissioner of Internal Affairs. In secondary school, I always enjoyed tinkering with electronics, mostly playing around with Arduino's en LED's. I did some very simple projects, such as making a LED cube or make LED's dance to music, but they eventually made me realize that I wanted to study Electrical Engineering. During my first introduction week, I found out that Thor is an awesome association and

I joined Ivaldi as soon as I could. After my first year, I also joined the ACCI, the LANCo and Volundr. Even though this year was a bit odd, I had a lot of fun organizing fun and creative activities. Last but not least, I also joined Het Tappersgilde recently, so I'm spending even more time in Het Walhalla than I already used to!

Op Het Walhalla & Geen gedonder! ◼

Hello everyone, my name is Koen Dijkstra, and I am the candidate Commissioner of External Affairs. I grew up in the city of Lochem. In high school, I met our candidate President, Mart, and we started to share our hobbies. Eventually, this led to us making electric guitars and basses in my father's shed in the garden. This hobby led to my interest in electronics, the reason I started studying electrical engineering. After the intro, I soon started to be active at Thor in

the first-years committee Ivaldi. After my first year, I joined the ACCI, and eventually Kvasir as well. Now we are here, at the end of my second year being a candidate board member. I'm really looking forward to next year as I hope to learn all sorts of new things and to give back to all the members of our association. I hope to see you all at our activities and of course in Het Walhalla!

Geen gedonder! ◼

Quality of real-time functional magnetic resonance imaging

By: Stephan Heunis

Breaking down the complexities of the human mind in order to understand and develop treatments for mental health conditions is an ongoing challenge in neuroscience research. If we are to make a practical difference in our understanding of these complexities, and ideally in the lives of those who are impacted daily, we have to rigorously and critically question the validity of our own research. It is therefore imperative that we ensure the quality of our own scientific measures, methods, and inferences. We (researchers at the SPS group in collaboration with Philips research) focused on doing exactly that for real-time functional magnetic resonance imaging (fMRI).

Real-time and conventional fMRI

Real-time fMRI is an advanced method that shows promise in allowing us to explore the human mind in a virtual, real-time and non-invasive manner. It allows quantifying and visualizing brain activity while a person is inside an MRI scanner (Figure 1: real-time processing), and can be used in brain computer interfaces and neurofeedback studies to investigate treatment options for mental health conditions. Underlying this technology is conventional functional MRI, which involves the time-dependent imaging of the oxygen concentration in the blood vessels in our brains. As energy is consumed by the cells in our brain to support their function, more oxygen is required, and these concentration differences show up on a functional MRI scan. These images, acquired every few seconds, are then analysed after the scan session to extract useful brain activity information (Figure 1: offline processing).

Data quality control

Offline fMRI processing, however, does not provide real-time information while the person is in the scanner, it can result in extra costs and delays if data quality issues are only detected after the scan, and its signal is biased by sources of noise such as head movement, fluctuating heart rate, and breathing cycles of the person being scanned. With real-time fMRI, these images of our brain activity are acquired, processed, and visualised while a person is inside the MRI scanner,
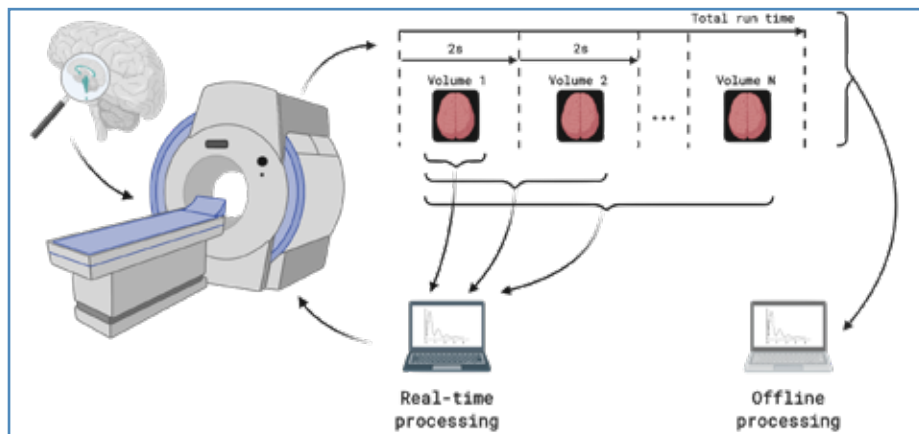

Figure 1: An MRI scanner can acquire functional MRI scans every few seconds. All of these scans can be processed after the scan session in order to extract useful brain activity information (i.e. offline processing), or during the scan session while someone is inside the scanner (i.e. real-time processing).
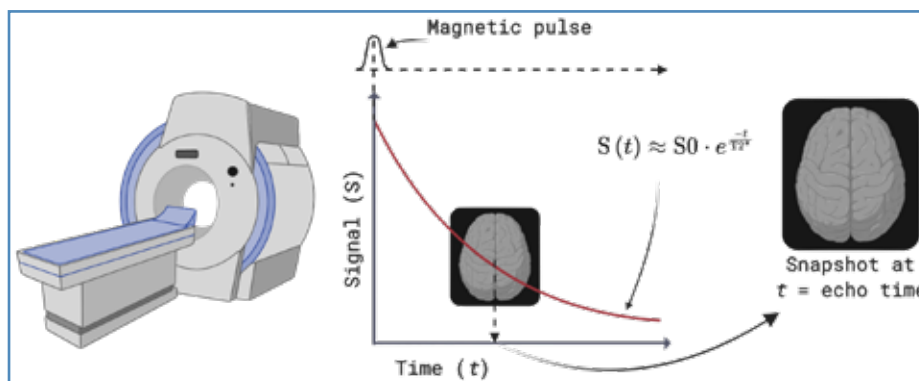
Figure 2: A graph depicting the mono-exponential magnetic decay curve and the acquisition of a single fMRI scan along this decay curve. The "snapshot" of the brain is taken at a short time (termed echo time) after the initial transverse magnetic pulse that is sent through the scanner. processing).
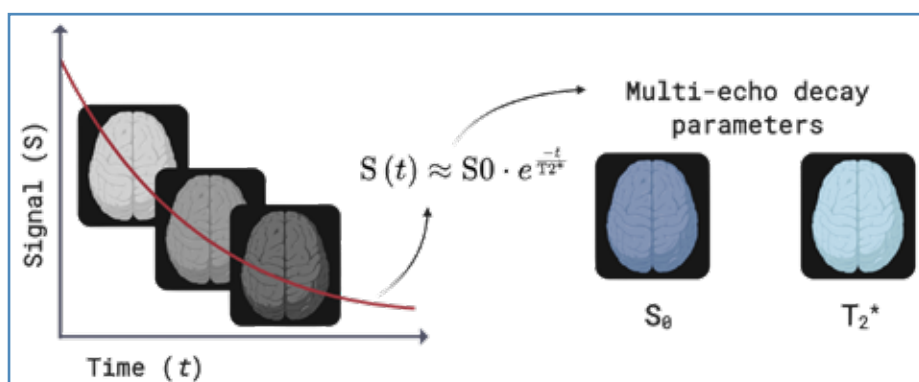
Figure 3: A graph showing the acquisition of multi-echo data, i.e. multiple snapshots of the brain, along the magnetic decay curve. These multiple data points can be used together with the known decay equation to estimate multi-echo decay parameters (especially T2) that are important for improving the quality of derived brain activity information.*

essentially providing a window into the   human mind as we think, feel, process

Figure 4: A depiction of the real-time fMRI hardware, communication and signal processing system that was developed using a 3T Philips scanner, the XTC communication protocol, and an external PC with MATLAB to process brain scans in real-time.

information, and make decisions. In contrast, real-time fMRI processing does provide real-time information while the person is in the scanner, it can prevent ext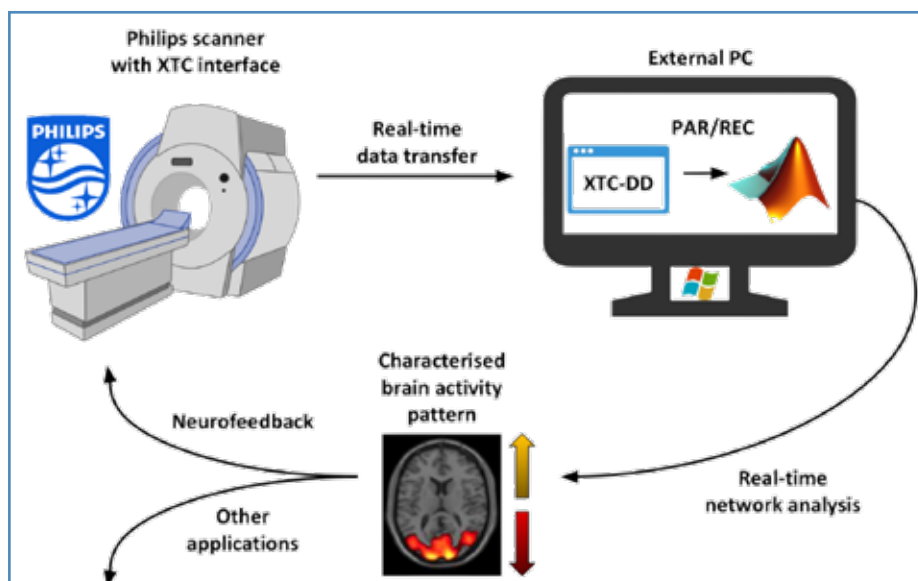ra costs and delays by detecting data quality issues during the scan, but it is still biased by the same sources of noise as conventional fMRI.

Researching the quality of real-time fMRI

But how well do we understand this technology and its practical implications, especially for healthcare? And how can we improve its quality to bring us closer to a better understanding of the complexities of the human brain? These were the central questions of this work, and we approached it with several goals in mind: (1) to develop a comprehensive understanding of real-time fMRI data quality; (2) to develop hardware and software for real-time fMRI analysis and quality control; and (3) to validate real-time multi-echo fMRI methods

Understanding real-time fMRI data quality

Literature shows that the vast majority of real-time fMRI studies focus on clinical applications while there is a stark lack of studies exploring and quantifying the quality of the real-time data, the effects of real-time processing methods, the validity of the employed methods and practices, and potential improvements to the aforementioned. By focusing our efforts in this domain, we identified real-time multi-echo fMRI as a promising ▶
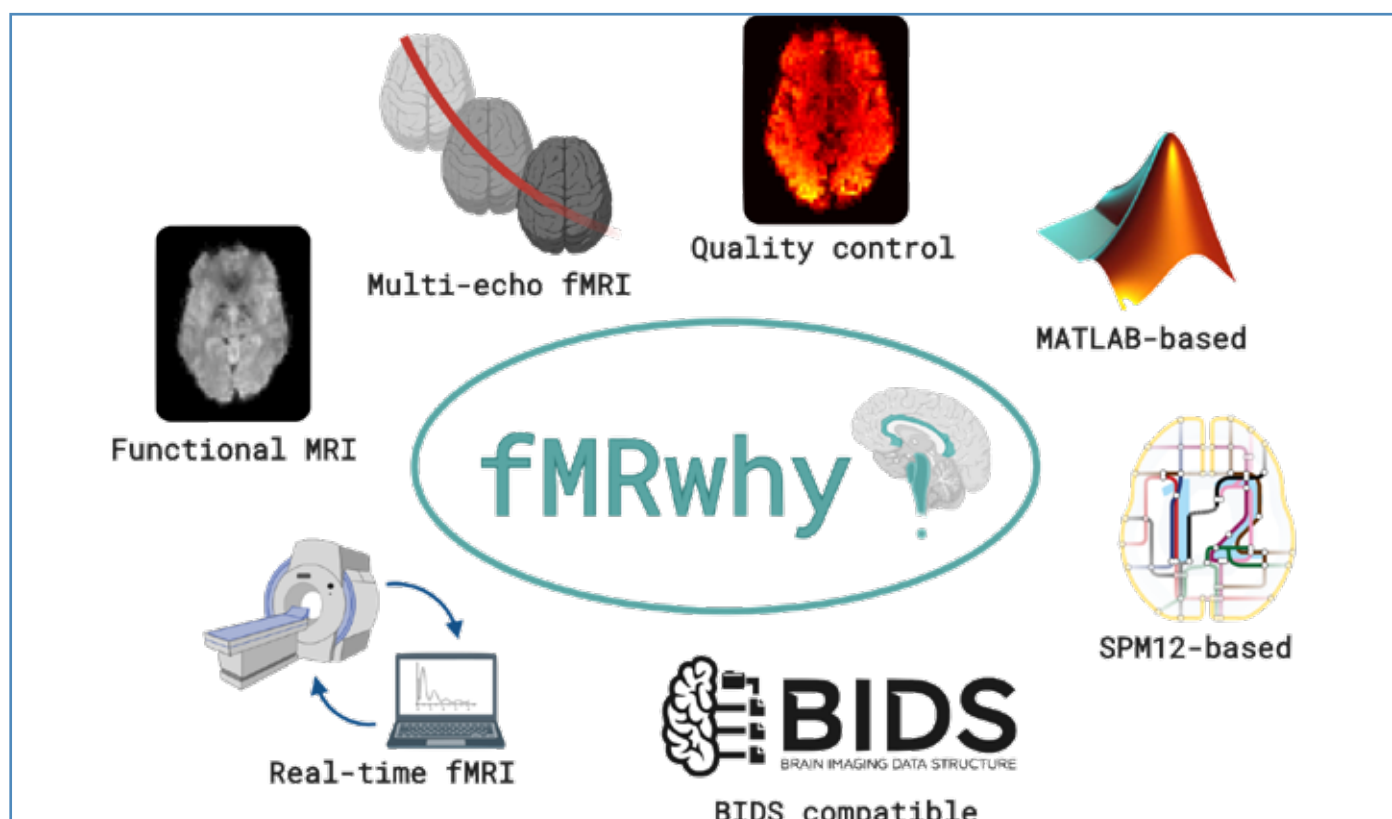

Figure 5: A diagram summarising the main aspects of the fMRwhy software package that was developed in this project. It is a MATLAB-based and Octave-compatible package that supports the processing of BIDS-standard formatted multi- and single-echo fMRI data for offline and real-time use cases, including automatic pipelines for quality control and reporting.

method for data quality improvement that is currently underexplored in the context of real-time fMRI. A conventional functional MRI scan is acquired by sending a magnetic pulse through the scanner, after which the signal in the magnetized brain tissue starts decaying according to a known equation (Figure 2). After a short time along this decay curve, a snapshot of the signal is taken to form a single fMRI scan. With multi-echo fMRI, the scanner sequence is programmed to acquire several images along the decay curve (Figure 3). Having access to this extra data allows us to calculate tissue-specific parameters, such as this T2* value, which is a closer estimation of brain activity than the conventional single image.

Hardware and software for real-time fMRI analysis and quality control

Together with Philips, we developed a technical system on a 3 Tesla MRI scanner that could acquire fMRI data, apply signal processing pipelines, characterise brain activity, and visualize this, all in real-time

(Figure 4). These developments laid the groundwork for adding a data quality control toolbox, which assists in identifying low quality scans as they are acquired. Additionally, novel signal processing methods were developed to enable the use of multi-echo fMRI data in real-time. These methods were packaged into an open source software package, fMRwhy, to stimulate community contribution and collaboration (Figure 5).

Validating real-time multi-echo fMRI methods

To validate our novel real-time multi-echo approach, we first collected, curated and openly published a resting state and task-based multi-echo fMRI dataset from 28 volunteers (rt-me-fMRI, Figure 6). We then used this dataset and our developed methods to compare the sensitivity of multi-echo-derived T2* signal to that of conventional fMRI and other more common multi-echo methods. We found that for particular cognitive tasks and brain regions, the real-time T2* signal showed a much higher functional contrast, and that this functional contrast persisted even in the presence of more

noise fluctuations. As part of publishing this work, we developed a user-friendly and interactive web application with which to explore the data and results visually: https://rt-me-fmri.herokuapp.com/.

In conclusion

The contributions made in this work resulted in the validation of novel fMRI methods that can extract a higher quality signal of brain activity for real-time use. Furthermore, we generated an open real-time multi-echo fMRI dataset and open software tools with which to process this data in a myriad of ways. The reproducible groundwork has been laid to allow the use of novel data, sequences, software and signals to further our understanding of the human mind, and what is left is for the interested researcher to accept the invitation and start exploring. Perhaps in that way, together, we can systematically conquer this ultimate challenge, piece by piece, and build up the theory and evidence we need to improve global mental health. ∎
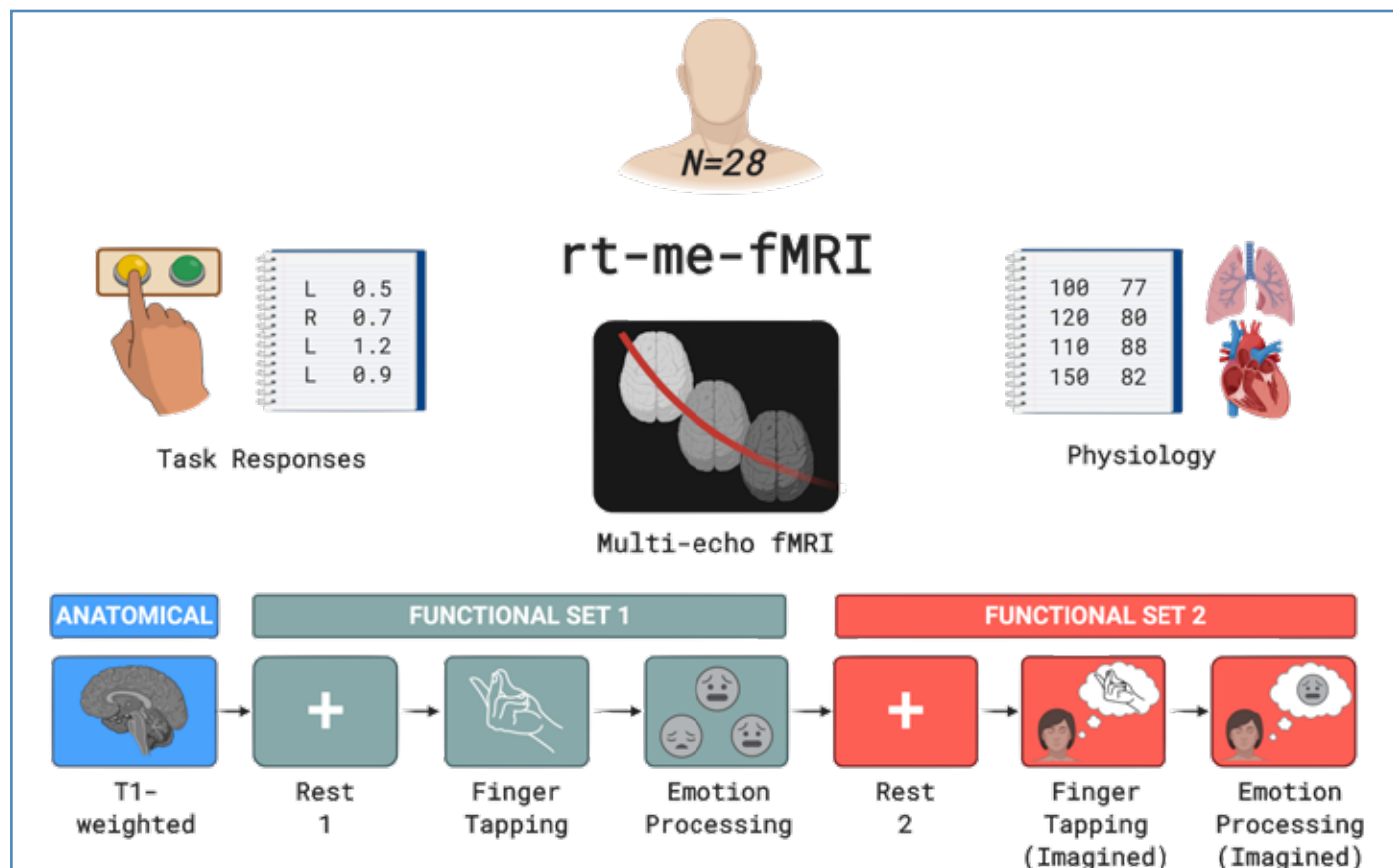

Figure 6: A depiction of the rt-me-fMRI dataset that was collected from 28 volunteers, including structural and resting-state and task-based functional MRI scans. Additional information related to the participants' physiology and task responses were also collected, and all data were anonymised to allow data sharing.

Working as a student at AME

By: Applied Micro Electronics

"**W**orking at a technology company really helped me get the most out of my studies." Thijs-Jan is a master student of Electrical Engineering and has been working at Applied Micro Electronics "AME" B.V. for almost 5 years. "I got to know AME during the CareerExpo at the TU/e when I was in the first year of the bachelor. I was excited when I heard that AME offers part-time jobs for students and I applied for a job immediately after the CareerExpo. During the first year, I worked as a Production Engineer and I was responsible for the automation of optical inspection of through-hole components. After that I was ready for a new challenge and AME offered me a job as a Test Engineer in the RD&D department."

AME is a developer and manufacturer of high-quality innovative products commissioned by customers. Interdisciplinary teams, consisting of Electrical, Mechanical and Software Engineers, work on turning the customer's wish into a reality. This process involves specifying, designing and qualifying the new product, often in multiple iterations. Once a design is ready for the market it is transferred to AME's largely automated factory, where the product is assembled and tested before being shipped to the customer.

A Test Engineer is responsible for developing test-setups that are used to guarantee the functionality and quality of the products. "In order to make a good test-setup, it is essential to analyze a product in depth and since AME develops and manufactures a wide variety of products, I was able to analyze many different products. This gave me the opportunity to learn how the theory I learned in college is put into practice. Not only could I use what I learned in college to become better in my work at AME, I was also able use the things I learned at AME to get the most out of my studies."

As test-setups generally consist of electrical, mechanical and software parts, the role of a Test Engineer is multidisciplinary. "Ultimately, all components are integrated into a working test-setup, which requires good communication between the various disciplines and clearly formulated technical specifications. In the end it is highly rewarding to see a test concept come to life through team effort, especially when a test-setup is being used to assemble and test thousands of devices."

AME's products are used in many different market segments, such as agriculture, smart charging and industrial and home automation, which is why each test-setup has different requirements. However, it is expensive and time-consuming to build a completely new test-setup for each product. To reduce test development effort and to improve reuse of existing test concepts, Thijs Jan and a team of engineers have been working on a Generic Test Platform. This platform consists of hardware and software that can be used for a wide variety of products, enabling a generic approach for future test development. "It is really exciting to see an idea we have been working on is now widely used in our lab and in our production facilities."

Thijs Jan is currently in the final phase of his master's degree and has just started his graduation project at AME. He will be working on 1-phase Power Factor Correction based on GaN switches for motor drives. "I am ready for a new challenge, AME has extensive knowledge of power electronics and motor drives and I am confident that they will provide the resources and knowledge needed to successfully complete my graduation project! I am happy that AME supports me in my growth and offers me the challenges I am looking for."

If you would like to know more about AME you can visit our website https://ame.nu/. ∎

Technology and John Dewey

By: Jan Vleeshouwers

In my journey through technology-land I recently encountered John Dewey, a US philosopher whose views resonate very well with technology and engineering. By coincidence, he also appears to be one of the first to recognize the importance of combining theory and practice in education, which he brought into practice in Chicago in the late 19th century. In the US, his views on education are still influential, but in Europe, his work seems hardly known. He deserves better: convinced as he was that people do not start thinking unless confronted with a problem, his thoughts found our efforts to develop Challenge Based Learning.

Dewey's core interest was not technology, it was education and good citizenship. Dewey used his background in philosophy to develop and substantiate thoughts on necessary reforms in the areas of education and citizenship [1]. Philosophy, in Dewey's opinion, is a tool to help us achieve results. Philosophy reflects, asks the right questions and provides bridges between the work and activities of people who would otherwise not understand each other. 'Inquiry' is Dewey's word for this bridging activity. In philosopher's jargon, he is called an instrumentalist and a pragmatist.

Education

Education, according to Dewey, is the main mechanism providing societal continuity. Since individuals live temporarily, a society must have a way to perpetuate its ways of working, its experience and its habits. Young humans go through a maturing process to become full members of society. Originally this process consisted of copying from experienced members and of playful imitation. But as societies became more complex, they organized and formalized the process. Formalized education is very visible; as a result the original, not so explicit target of incorporating the young into society became hidden.

What also disappeared from view was that education does not happen in formalized settings only. Dewey stresses that once we see the breadth of societal activities which have an educational effect, i.e. which shape people, the young but also

the older, then we also see how practice fits into this picture as an undeniable element of education. Dewey drew the logical conclusion and practiced what he preached: his pragmatist conviction shows in many of his activities.

Good citizenship

Education is a two-way street: society needs to shape new members for its continuity, but new members also need to take up their role properly. They have to be "good citizens", and bring society forward. That is not a static concept; societies change and continuously face new problems which need a response. So on the one hand, a good citizen must use one's talents and on the other hand, a good society must allow citizens to use them. A member of society is not a mechanical cog in the societal wheel, nor an egoistic individual just chasing one's own interests. It means using one's knowledge and tools for inquiry, i.e. to reflect and act, address whatever problems society faces.

This is what Dewey calls a democratic society: a society which "social organization makes provision for this direct participation in control". "A social return be demanded from all and that opportunity for development of distinctive capacities be afforded all." "A society which makes provision for participation in its good of all its members on equal terms and which secures flexible readjustment of its institutions through interaction of the different forms of associated life is in so far democratic." This may not be the general concept we have of a democratic society, but it is not Dewey's intention to define the concept of 'democracy'. Rather, he formulates the optimal way for a society and its citizens to support each other and labels it more or less appropriately.

Thinking and solving problems

Dewey's pragmatism extends Dewey's view on what constitutes a good society. Most of the time its members act out of habit, just like all organisms on earth. But when people encounter problems, they start thinking, which leads to some kind of adjustment of what they do and how they do it. It results in changing their own
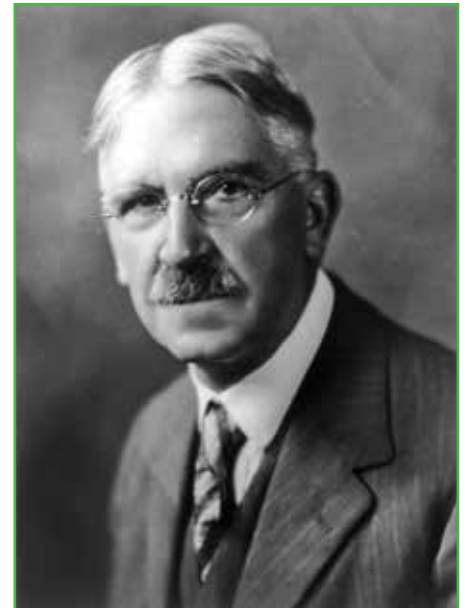
behavior, changing their environment, or both. This adjustment gradually turns into habit again.

The conscious process of thinking and acting to solve a problem is what Dewey calls 'inquiry'. In this inquiry there is a mixture of theory and practice, of mental activity and physical activity. They cannot do without each other. A second, even more interesting aspect of inquiry is that is uses tools of all sorts and kinds, physical as well as mental. We are getting closer to technology now: problems which are solved using material tools can easily be associated with technical activity. But Dewey does not feel a need to treat immaterial tools differently. Mathematical concepts as an integral or a vector space, or psychological concepts as the ego or the mind, and even common daily concepts as the census, planning a meal, the image you have of what's outside you front door: they are all tools, used by humans to solve problems. So knowledge in general is a tool, as are science and philosophy. This is Dewey's 'instrumentalism'.

Tools

Other philosophers have of course reviewed these ideas critically. If I summarize very roughly, there are two kinds of objections. One has a bit of an emotional background and says that all these human creations, material as well as immaterial, are much more than tools; works of art and religious ideas are stripped of their real value if reduced to tools. The other one is that in following Dewey's generalization, everything seems to become a tool, so the idea of tool becomes rather meaningless.

In 'Tuning up Technology' [2], Larry Hickman, philosopher and emeritus director of the Center for Dewey Studies in Illinois, responds to these objections. Hickman says that viewing something as a tool is not a desecrating thought, and using an object as a tool does not prevent it from being viewed in other ways as well. Hickman also denies the 2nd objection, that Dewey's view makes everything into a tool, but that is not convincing, if I am honest. Most engineers would probably confirm that

everything can be a tool. It is not a criticism, but just an observation and therefore does not need repudiating. It only indicates how full of tools our world is, or more precisely, how full of potential tools, and how essentially human it is to use tools.

Technology finally

Dewey must have been aware for a long time how close technology was to his instrumental views, but he did not express it until 1946: "It is probable that I might have avoided a considerable amount of misunderstanding if I had systematically used 'technology' instead of 'instrumentalism' in connection with the view I put forth regarding the distinctive quality of science as knowledge" [3]. So Dewey says that all tool use is technical, no matter if these tools are material or immaterial. This may seem a little overdone at first sight, but alternatives are less attractive. Any alternative would have to draw a line between technical an non-technical tool use somewhere, while all tools would remain to be usable for inquiry. A straight-forward idea would be to distinguish between material and immaterial, but that does not separate the technical from the non-technical. Immaterial concepts as information, algorithms, systems, control, and even voltage and current, are all tools which we would most definitely call technical. Other ways of separating out technical tools from the tools domain have been attempted , but none satisfactory. It seems as if nature is reminding us of how thoroughly intertwined technology is with human life.

Technology and engineering

Summing up, John Dewey's philosophy of society and education identifies three main things which hold human societies together: there is science, the body of knowledge of how nature works, there is technology which encompasses the

tools to change the world, and there is education to provide the continuity. All three concepts need a bit of imagination to stretch them sufficiently wide, as I hope is clear from the text above. But more notably, none of the three is a matter of choice: they are humanity's core, humanity cannot do without. What humanity can do, is use them sensibly, via the way of inquiry. That is not an easy thing to do: it is behavior which is shaped by a long evolutionary process and that makes them tough as well as elusive.

As far as I can tell, discussion and debate on Dewey's concept of technology and tools have focused on philosophical issues, not on their implications for technology and engineering. But something may be concluded from Dewey's instrumentalism, since technology is the essential source of societal and environmental change. For engineers, who are at the root of this change, it implies that they should be societally rooted and should be masters in 'inquiry', because how can you forge relevant change at random? And it also implies being both scientifically knowledgeable and practically robust, because knowledge and practice are inseparable.

Does that mean the Challenge Based Learning is the ultimate solution for technical education? Not, of course, if it means that theory-without-practice is simply replaced by practice-without-theory. But if it is a pars-pro-toto concept which provides engineers-to-be with a balanced program, with solid knowledge as well as a solid respect for the stubbornness of practice, then yes. Of this stubbornness, by the way, the more than 100 years of history between Dewey's ideas and our present endeavor is a perfect example. ■

[1] John Dewey, "Democracy and Education", 1916. For a full text, transcribed by David Reed, see https://www.gutenberg.org/files/852/852-h/852-h.htm.

[2] "Tuning up Technology", in "Philosophical Tools for Technological Culture", Larry A. Hickman, 2001.

[3] Dewey, J., "Problems of men: Philosophical essays." New York: Philosophical Library, Inc. (1946, p.291).

Intro 2021: back to (almost) normal

By: David Blom

Organizing an introduction week is always a hassle for a committee. It requires a lot of quick thinking, and most of all, it requires a lot of damage control, without making it seem like the damage control is needed. This year, the introduction week again was different from normal. Corona was still in play and the scenario had changed so much, that we only received the final planning a week before the actual introduction week. Even when the odds were against us as a committee, I'd like to believe the new bachelor students enjoyed their start, as well as the new master students, who got to see more of Thor during the Master Kick-Off than previous years.

The organization of an introduction week starts quite early. The Thor Introduction Committee was installed around March and the first communication with the Central Introduction Committee started soon after. This communication was rather different from previous years. Instead of a clear protocol and planning, we did not receive any guarantees and a fixed planning for the introduction week. Due to the volatility of the corona crisis, it was very hard to set something in stone for an event that was a few months away. As a Thor Board member myself, I have come to learn this struggle as well. This meant that there were a lot of iterations

Photo 1. Last minute fixes had to be made to the draft car

on the planning and idea of the introduction week before the final planning finally arrived. The first planning was very strict, due to the smart lockdown, but when the pubs opened up again with Testing for Entry, we were told an almost normal introduction week with a party every evening was possible. Even though this sounds very promising, we still had to take the corona virus possibly causing a new wave any moment into account.

This means that we also had to think of online activities, workshops, and information videos. As you might imagine, having to consider multiple scenarios is quite hard when working out concrete plans.

The Testing for Entry and 'Dansen met Janssen' unfortunately took a wrong turn, causing all the pubs to close again. This also meant that the parties of the introduction week vanished in an instant. All the associations were quite sad but understood the measures that had to be taken due to the financial uncertainty. Therefore, we told the central introduction committee that we as study associations could organize a party in just a week or two if they received good news. This was purely because we too craved a party and wanted to give the new students a week they would not forget. Organizing a party for 750 people was, however, harder than we all imagined, and it took a lot of manpower, expertise and pure coffee infused stressful working hours to realize.

The weekend before the introduction week is when the final preparations are done, and everyone involved is briefed. All the equipment is taken out of storage, labeled and categorized, so there is a clear structure. It only took one day of

Photo 2. Parents trying to get the attention during the check-in

Photo 3. kandi's were, as usual, getting soaked

the introduction week to completely mess up this structure, but the sentiment was there. Sunday and Monday were the busiest days, as everything took longer than expected. Our 'draft car' (a car that drafts beer from the boot), decided to break down and hinder us in every possible way, and we had to build a mount on a trailer for our barbecues to accompany our draft car in a day. Every board member, and candidate board member was busy with their own task and I can assure you, they all skipped at least one of the three meals in a day. Monday evening, everything finally fell into place and we were ready for the offline introduction week to start the next day.

The Tuesday of the introduction week was the longest and busiest day of them all. We had to check in 280 students, make sure they kept their distance on a field, whilst making them feel welcome, showing them the craziness of the student life and informing them about everything they needed to know. Finding a complete intro group was quite hard, because every now and then, an intro parent or kiddo vanished to get tested at the Beursgebouw for the party that evening. This was highly inconvenient for us, but unfortunately, this was the only way.

In the afternoon, we hosted a business case throughout Flux, which some of you might have noticed. The rooms on the ground and first floor were remodeled,

which meant we had to use every master working space we could find. As preparation, we counted every seating place we had reserved throughout the whole building, to make sure we had enough. In the meantime, our candidate board hosted water games on our field near the building Aurora, which all worked according to a planning that almost did not fit on three A3 sheets. After the business case, it was time for a dinner, also organized by us as an association. We mounted a huge barbecue for all the involved people, and in timeslots, the intro groups had to leave their dinner spot to enjoy in Het Walhalla for a short

time. This is where Het Walhalla was symbolically opened for the kiddos by Bart Smolders. As a bonus, he was able to do it four times this year, because of the current maximum capacity of Het Walhalla.

This might all sound very busy already, but while all this was going on, people were working from 9:00 till after dinner to organize a festival for 750 people on campus. Beer had to be transported from Helmond to Eindhoven, while all the bars had to be connected to the main grid to cool down in advance for the party. Since the organizing time was so short, we could not find an entire podium within our budget, so the back of a truck became our podium. A lot of people with expertise in all the right fields helped us out throughout this very busy day to get the festival up and running quick enough so the intro parents and kiddos could check-in after their dinner.

With a lot of volunteers at the bar, checking QR-codes, at the coin sale, securing the general terrain and with two amazing DJ's, we managed to get the festival going and delivered an amazing party worthy of the introduction week. It took until four o'clock to clean everything up, and everyone, from the organization and the volunteers helping late, was entirely broken at the end of it. Hearing the enthusiasm from everyone who enjoyed the party, was however worth everything. ►

Photo 4. Meanwhile, the kiddos were struggling on a business case

Photo 5. A barbecue for 350 people was organized

The next day, we hosted a tour through Flux and informed the upcoming students about a lot of different organs within our Department. In the afternoon, the campus was transformed in a gigantic market, where every association could present itself. We still had some food left from the barbecue, and our barbecue trailer made it very convenient to start preparing food on the spot. This made us quite popular on our field behind Atlas, because walking around all day means you also need proper nutrition. Together with some small games and a outside bar serving ice cold water and lemonade, we made sure people would feel at home at Thor and will hopefully have positive memories to remember us and our department by.

On the Thursday, all the intro kiddos could get to know Eindhoven in a huge tour past landmarks and associations in the city and on campus. We as a study association did not have an official program here, and we did not mind. This day was a gift to get our bearings, organize all of our stuff again and tidy up the gigantic mess that had appeared in our Board room and other member spaces. Most of all, it was a day where the introduction committee could relax and get some much-needed rest or sleep. Unfortunately, the only room we have that contained a couch, was transformed to storage space. Some quick thinking led to one of us taking a couching and powernap under a table in the Board room to have enough energy and enthusiasm for the next and last day.

It is customary that the brunch organized by the study associations starts at 7:00 on Friday. However, this year there was no 'doorhaal donderdag' so we did not expect to disappoint anyone if we started at 9:00 instead of 7:00. Mind you, that the official program would only start at 10:00. Nonetheless, we had

Photo 6. On Tuesday evening, the kiddos and parents could enjoy a massive party

Photo 7. During the department tour, Het Walhalla was also shown

Photo 8. The brunch meant a massive barbecue-pancake pipeline to be organized

some diehards asking us at an ungodly hour if there would be food ready at 7:00. Having disappointed these people, as the ingredients for the brunch did not arrive until 8:00, we got our barbecue-pancake setup ready at 9:00 accompanied by loads of coffee and a huge brunch. Looking around we could see a lot of tired faces and even some kiddo's who were suffering from a headache. The gadgets gifted to the kiddos by their intro parents were becoming more familiar to the intro kiddos and they seemed more at home at the campus, or at least, they will be able to find their way around campus when the academic year will start.

On Friday afternoon, we hosted two workshops for the last official section of the program. Our Tappersgilde taught kiddos how to draft a nice beer (from the boot of our draft car), and our candidate board showed kiddos how to look dapper by teaching them how to tie a tie in different ways. Some rain disturbed the workshops, which meant that we had to hide all the equipment and halt the workshops. However, after an entire week of fun, enthusiasm, new faces and hard work, this could not break our spirits even a little bit, and despite the rain, we closed the introduction week with happy faces, a positive ambiance, and some new friends.

The next week, we helped organize a smaller introduction for the new master students. We enjoyed a good collaboration with the department, and together, we planned the Master Kick-Off. In a huge carousel, every research group and organization that was relevant to the master students were introduced, and this was followed by a barbecue together with the study association for Applied Physics, our neighbors Van der Waals, so the students could also meet their fellow Flux residents. To close off this day, the new master students of Electrical Engineering and Applied Physics were invited to Het Walhalla and de 'Salon', with an infamous Open Wall Drink where the Tappers from Thor could mingle with the Borreltenders from Van der Waals while serving drinks. On the third day of the Master Kick-Off, we organized a puzzle workshop to familiarize the new master students with Thor and the TU/e in general.

Overall, we've put a lot of energy into these two weeks of introduction for new students. I've managed to sleep for about twelve hours the night after the introduction period and looking back, we have learned so much and have received so many positive messages from the people as we they've had a week worth remembering!. ■

Photo 9. On Wednesday afternoon, all associations were shown around the campus

Photo 10. The workshop during the MKO

In RetrospecThor

By: Manon Eijsvogel, Elles Raaijmakers

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 64th Board. As we've recently passed the golden boundary of 50 Connecthor issues, we're closing in on 'recent' board years. In the upcoming Connecthor issues, we ask 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 55th issue, Manon Eijsvogel, President of the 55th Board of e.t.s.v. Thor, has written about her experiences in collaboration with her fellow Board member, Elles Raaijmakers, Treasurer and Commissioner of Education of the 55th Board of e.t.s.v. Thor.

Manon & Elles

It is not easy to summarize all the things we both have learned from being a Thor Board member, especially since we only got limited space to do so. Luckily, there are some things that nearly every young Thor Board member encounters, like dealing with responsibilities, cooperating with a range of people with different interests, organizing and advertising events and even making difficult decisions. You truly must reinvent yourself – multiple times! It is fantastic to have had the opportunity to really get to know yourself and push your limits before starting your professional career, as it gives you a real head start. Here, we summarized some of the most important lessons we both learned and still enjoy today while practicing our jobs.

Cooperating with different people

The start of our year-in-charge was not an easy one; we were a group of only four instead of the (then) usual six Board members. This forced us to learn how to cooperate and communicate really quickly. This was not easy, as Elles' "laissez faire" mindset and Manon's urge to be in control and always have a plan B and C worked out did not exactly go hand in hand from the start. But after a few (inevitable) clashes and chaotic events, Elles had to admit that thinking and planning ahead of situations came in handy. It saves a lot of stress if you come

to meetings and events well-prepared. And Manon realized that, even when you have everything worked out, there are always situations that do not work out as planned and that that is okay. The skill of thinking on your feet can help to solve many issues. And this illustrates, we think, one of the most important lessons we picked up during our year together: The people you disagree with the most, are often also the ones you can learn from.

Today, cooperating with different people with varying mindsets is a skill that comes in handy in both our jobs. As a team-manager and as a teacher, Manon and Elles have heard a wide range of creative excuses why tasks or homework assignments have not been finished (it is never the fault of the person at hand, of course). Still, after facing so many colored personalities, carrying big responsibilities, and making and communicating difficult decisions during our Board year, these kinds of confrontations are easy to deal with. There is always a solution and shared interests, and even the most defensive employee or student is ultimately willing to find a compromise.

The sky is the limit

Another interesting change of character we both experienced is the ambition we gained. The goals we set at the start of our understaffed Board year were

"keeping Thor alive" more or less. And Elles would have been happy to stick to that, but eventually got inspired by Manon who saw we had more potential than to just keep the association afloat. After organizing a few successful events, Manon started helping with the organization of the five-yearly anniversary of Thor and even managed to get involved with the planning of the new Walhalla in the Flux building – something many fans of coziness and alcoholic beverages still make use of to this day. Not wanting to stay behind in ambition, Elles started a webcomic about the god Thor to provide the association with a (in her opinion much-needed) way to reflect upon itself with some humor. You can complain about people leaving their waste in the common room a hundred times, but you can also confront them through a drawing to point out that we do in fact have trash cans.

In retrospect, we are both proud to have found novel ways to use and improve our talents in unexpected ways. When you have a job, the opportunities to really think outside the box are more limited and there is less time to dive into a crazy dream or project. The Board year really helped us to find time and opportunities

to try new things and go for it. For instance, Manon still uses the leadership skills she developed for her job as a team-manager, and Elles still uses visualization to aid with teaching and communicating her research results – skills we might not have picked up otherwise.

Trying new things

Improving the talents you already know you possess is one great vice of a Board year but placing yourself in the position where you can accidentally discover you have hidden abilities is next level. Manon previously found it difficult to connect to new people. Still, she got to know many new folks and realized that there are some things all students have in common – a love for their pubs. Bragging about our beloved Walhalla is usually a great conversation opener, and sharing ideas with other study associations has helped to shape the role the Walhalla would ultimately get in the (then future) Flux building. Even today, determining commonly shared interests helps to connect with new colleagues or associates.

Elles never truly got a grip on her market value before her Board year. As long as others were happy, there was no reason

to complain, or so she thought. But gradually, she realized that her demands counted as well. She quit her bachelor end project because she found out that the project was not as diverse as she initially thought – something she would have never dared to do before her Board year. Eventually, she found a much nicer project that truly interested her. Up to this day, Elles makes use of the idea that it is not rude to stand up for yourself. It is realistic to make demands, and you gain respect by clearly communicating them.

Summarizing

There are many things you can learn from a Board year at Thor – these are only a few important ones. We have picked the more serious topics, but of course we did not forget to go to parties, stay up waaaaay past bedtime and have a lot of fun. Thor is a wonderful sandbox – you place yourself in a position with a lot of responsibility, but there is a safety net in case things go wrong. Moreover, if you do things right, semi-eternal fame in a select group of future engineers awaits you. And if you do not believe us, feel free to try the adventure yourself. ■

Names: Manon Eijsvogel / Elles Raaijmakers

Current Jobs: Teammanager at Alliander / Teacher & PhD student at TU/e

Studied EE: 2009 - 2016 /2008 - 2015

Activities at Thor: Many! Manon joined 15 committees including ToeCo, JaBo, ReisCo and WaCo (twice), and Elles finished 11 ones including Connecthor editorial board, ReisCo, BuEx and SymCo.

Other: We were both part of the 55th Board of Thor: the first ThorBoard with two ladies, and still the only Board with an at least 50% female-to-male ratio (but ambitious ladies are of course welcome to challenge this statistic).

How to find your soulmate in the least expected place

By: Lucia Kalkman

When we, the 64th board of Thor just started, we already made jokes about organizing a first dates for the TU/e. However, that was never really an option, until a couple of months ago, the university made some money available for more social, fun activities to take place to enhance the social life of students. This is when the idea of organizing first dates came up again, along with some other wild plans. After some time, we decided to drop the other plans and start organizing First DaTU/es.

Just like in the real First Dates, we started by making a webform people could fill in to participate. This webform didn't only ask about the day and time they were available, but also if they were looking for a date or just a friendly dinner. In case of the date, we would ask for some pictures, questions about their personality and the type of people they fall for.

Of course, engineers are scared of too much social contact, but after some weeks we had about 80 to 90 subscriptions and we could start matching based on all the information from the questionnaires and the seriousness they were filled in with. This took a lot of time, but in the end, we feel like we made some truly good matches!

In the beginning of the summer holiday, the event finally took place. On Monday, when the first dates would take place, we decorated Het Walhalla, designed special First Dates beer cards and the bartenders freshened up their cocktail-making skills. To make sure everyone would be able to get the conversation started, we prepared some questions and placed those on the tables. When the evening started, people would come in with certain intervals, to make sure everyone would have their time at the bar to have an awkward conversation with one of the bartenders. After that, they would have dinner and at the very end, they would be asked the question whether they would like to see each other again. All in all, everything that happens at the 'real' first dates.

One day later, on Tuesday, our entire world fell apart. One of the bartenders tested positive for COVID-19, and the entire organization (and some others) had to go in self-quarantine. Instead of watching dates, we had to cancel all the dates and spend the day watching Netflix in our own rooms. However, at the request of some of the participants, we asked for permission to sent everyone the contact details of their match, so they could still date. From that moment on, it was all out of our hands.

In the end, the activity still ended up being successful, as multiple couples even went for a second date. For the others, it was just great to finally meet some new people after months when this has not been possible. Even if they've not found their soulmate or a new friend, they have at least had a fun day, as have we! ∎

# In memoriam: Em. prof.dr.ing. Hans-Jürgen Butterweck

By: Various authors

Hans-Jürgen Butterweck was educated at the RWTH Aachen (MSc 1956, PhD 1959) and became a lecturer at RWTH Aachen in 1958. He moved to Eindhoven in 1964 to join Philips Research, and in 1967 he joined TU/e as a full professor in Theoretical Electrical Engineering with a specialization in circuit theory. Prof. Butterweck should be considered one of the pioneering professors of Electrical Engineering at TU/e. He quickly built a group with -at that time-young, promising scientists and dedicated research assistants who were at the scientific frontline of circuit theory. He also served several stints as chairman of the Theoretical Electrical Engineering group. Over the years, the emphasis of his research shifted increasingly towards the then emerging field of signal processing. In 1992 this led to the establishment of the Electronic Signal Processing group, which was the predecessor of the current Signal Processing Systems group.

Prof. Butterweck was a kind-hearted, honest and friendly person who always showed interest in the wellbeing of his colleagues and others.

For us as former students, he will perhaps best be remembered by his outstanding teaching skills. Many generations of EE students had the privilege of being inaugurated into the secrets of circuit theory and frequency analysis by prof. Butterweck and will fondly remember his lucid explanations and his excellent book.

After his retirement in 1994, prof. Butterweck continued to be scientifically productive and for many years he was a frequent guest in the emeriti room on the 9th floor of E Hoog. His final scientific accomplishment was a wave theory of long adaptive filters that establishes an intimate connection between signal processing and circuit theory, effectively making his long career come full circle.
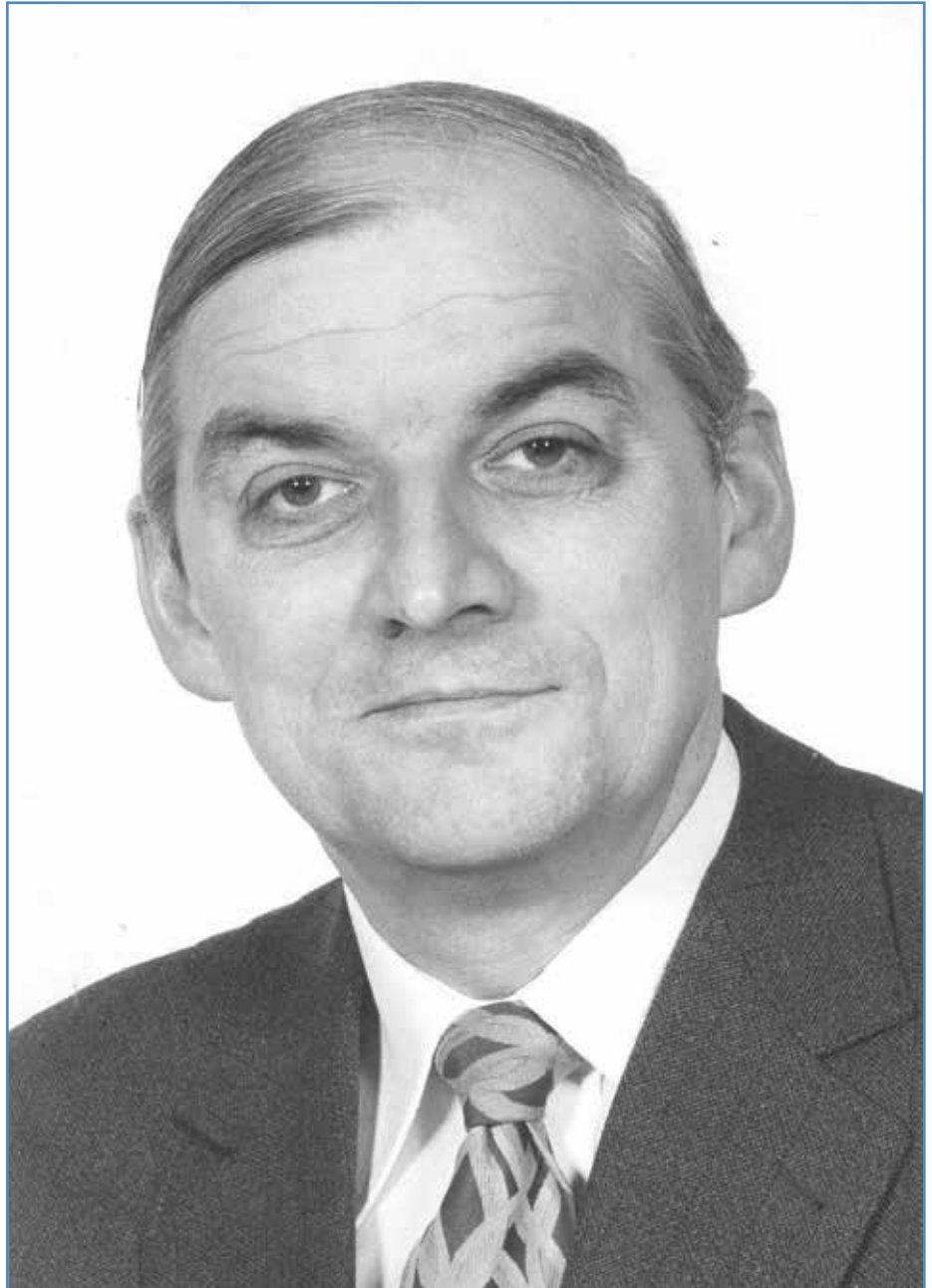
We owe him a debt of gratitude for his many contributions to our department.

Martin Bastiaans, Jan Bergmans, Pierre Cluitmans, Bart Smolders ■

Puzzle
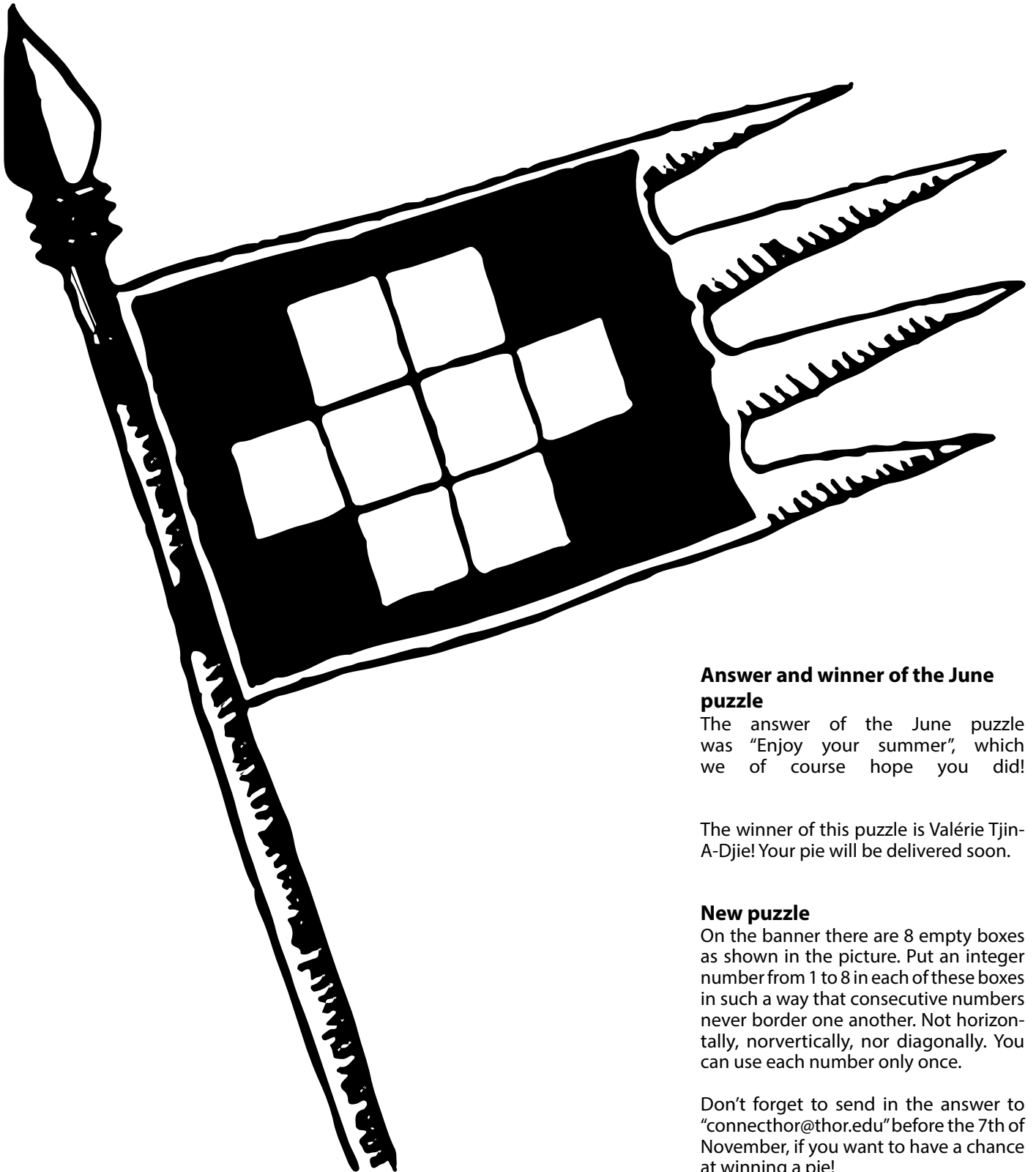
Answer and winner of the June puzzle

The answer of the June puzzle was "Enjoy your summer", which we of course hope you did!

The winner of this puzzle is Valérie Tjin-A-Djie! Your pie will be delivered soon.

New puzzle

On the banner there are 8 empty boxes as shown in the picture. Put an integer number from 1 to 8 in each of these boxes in such a way that consecutive numbers never border one another. Not horizontally, norvertically, nor diagonally. You can use each number only once.

Don't forget to send in the answer to "connecthor@thor.edu" before the 7th of November, if you want to have a chance at winning a pie!

Just walk away

By: Tom van Nunen

A group of students has recently demanded the board of our university to break ties with fossil fuel companies, among other things.

This sounds intuitive: company X is doing things that are bad for the climate, so we stop collaborating with this company. Just as you could move to another bank when you feel like your current bank is investing in wrong projects. But is this really the whole story? Let's look at the bigger picture.

Let's get things straight: I think climate change is a big problem and we should do everything we can to address it, and I doubt we're currently doing enough. It's also clear to me that petrochemical companies and the users of their products have a significant impact on the climate. More responsibility should be taken.

That means that also the TU/e should take its responsibility. I'd like to say that one way of taking responsibility is to maximize the impact you have on battling climate change. This can happen on a broad range of subjects: energy consumption of buildings, the available menu in the canteen, discouraging the use of cars, but also in more abstract things like the collaborations with industry.

The demand of this group of students is clear: stop collaborating with fossil fuel companies altogether. No more projects in collaboration with Shell, ExxonMobil, BP, and many more similar companies. But is this really the way the university maximizes its impact on battling climate change?

What will be the effect when we stop collaborating with them? Will they sell less products? Will they emit less greenhouse gasses? Will they take their responsibility and implement innovations all by themselves? Are they more capable of implementing innovations without our help, than with our help?

The fact that these companies have a significant impact on the climate, implies that innovations in their processes could also have a significant impact in the other direction. So indeed, it makes sense to look at those companies when we expect change.

What would be the effect when – just a though experiment – we would intensify our collaboration with these companies? When we combine the bright minds working at our university with the financial and logistic resources of these companies? Wouldn't that be better on the long term? And wouldn't that effect eventually be much larger than – for example – having a CO2-neutral campus?

To me, breaking the ties with fossil fuel companies feels a lot like walking away from the problem; the world is on fire, but at least we can say we're not the cause. Yeah, that's kind of true, but we're also not doing everything we can to stop it.

Sure, there are some side notes. For example, we should demand that we only work on projects focused at a better future. The impact of these projects should be more important than the money we can earn from them. But that can all be negotiated and arranged.

It would be interesting to see what would happen when all of their customers would suddenly stop buying their products, what that would do to their efforts in battling climate change, but I think it's fair to say that this is extremely unlikely to happen in the coming decades (although I very much hope I'm wrong).

Until we've reached something that even slightly resembles utopia, we have a long way to go, and we can only do it together. Remember that we all can have an impact, and that all efforts count, as small as they may be: millions of tiny efforts together can have become significant. ∎