



MACHAZINE

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Wiskunde
Informatica
Studievereniging



'Christiaan
Huygens'

BRAND NEW COLUMNIST

**Felienne
Hermans**

AN UPDATE ON THE

Lustrum

INTERVIEW WITH

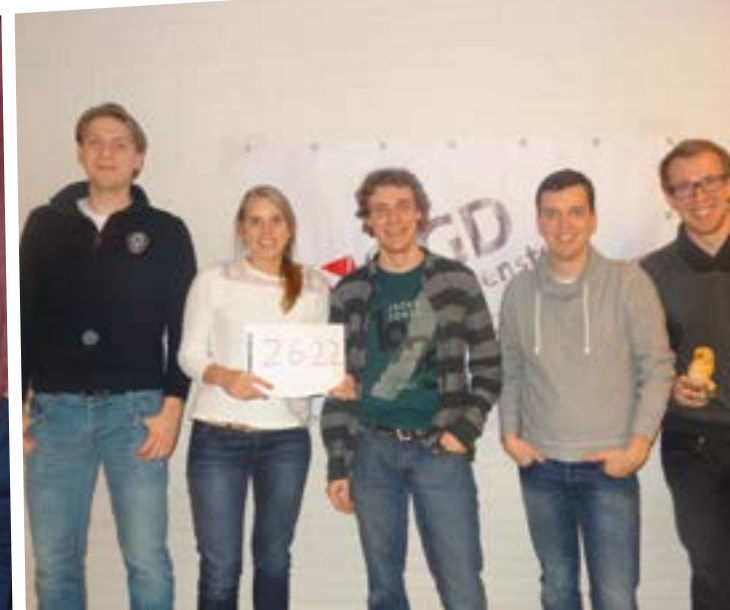
**Prof. dr. dr.h.c.
Rothkrantz**

HISTORICAL PERSON

Leonhard Euler

CONTAINING:

CURRENT AFFAIRS | ASSOCIATION | COMPUTER SCIENCE | MATHEMATICS | MISCELLANEOUS





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Maikel Kerkhof

So here it is, the last MaCHazine of this academic year and my very first editorial ever. The last quarter has been really busy for me, with lots of awesome CH activities but also a lot more serious things, like making sure to pass all my exams. But with a new quarter also comes a lot of free time! Fortunately there are enough of events and activities already planned, like the iCom trip to Dublin, the presentation of the yearbook Klasse and the second edition of Area FiftyLan.

Before I start talking about all the past and upcoming activities, first some updates regarding the MaCHazine committee itself, because a lot has changed the last couple of weeks. First of all, we had to say goodbye to Daan who, after years of hard work for each edition of the MaCHazine decided it was time for him to stop and focus more on getting his Bachelor's Degree in Computer Science. Thank you Daan!

To fill the empty spot Daan left behind, we also asked some new people to join the committee. I would like to welcome Daphne and Irene to the MaCHazine and hope they'll have a good time working on the future MaCHazines.

We are continuously working on making the MaCHazine better and more fun to read for all of you, and to get a good view on how you think about its current form we asked you to fill in a survey. A lot of you did and we are still receiving responses! We already tried to do something with the feedback you gave, and because a lot of you mentioned that they really liked the puzzles and wanted them back, we added a binary puzzle to the Computer Science section. Good luck solving it!

As I already mentioned, there also have been a lot of activities. The CHoCo just had their parent's day, which was a big success, and while I couldn't join myself, the stories about the very first WiFi rally sound awesome! Some more time ago, the Dies organised a week full of awesome activities to celebrate our association's 59th Dies Natalis, which included an exciting escape room, a cocktail night and even a city trip to Utrecht. You can read all about these activities in the association chapter of this issue.

A new quarter also means a lot of new exciting upcoming events! At the moment, the first upcoming activity will be the brothers/sisters party organised by the CHoco. The next big event after that will be the iCom trip on the 10th of May, on which more than 30 second- and third-year students will visit the famous Trinity College and companies related to computer science and applied mathematics in Dublin. To top it all off, the second edition of Area FiftyLan will be held on 3-5 June at the Drebbelweg. It looks like this edition is going to be an even bigger success than last year, with more games, more competitions and even more prizes to win!

One last thing to do before I stop keeping you from reading the rest of the MaCHazine is a shout out to all of you, the readers. The survey was a success and gave us insight in what you like to see changed in future editions of the MaCHazine, but I would like you to remind you that, if you ever come across something that you find fascinating or an event or article that you think should definitely be seen or read by all your fellow students or colleagues, please don't hesitate to contact us! You can always mail to machazine@ch.tudelft.nl or speak to one of us directly. Have fun reading this MaCHazine!





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From the Board

Inoni van Dorp

When the MaCHazine-committee asked me to write the 'From the Board' piece for the last issue of Volume 20, I suddenly realized how fast this year is going. For me as Chief Commissioner of Public Relations, the highlight of my year was a few months ago. However, there are still loads of things to do before the summer!

As Chief Commissioner of Public Relations, I probably am the board member who is most absent from the study association. This is not because I don't like being at CH, but because most of my tasks consist of visiting companies or meeting with my other board members of 'De Delftse Bedrijvendagen', who are unfortunately not located in the EEMCS faculty. These regular visits during the week provide a lot of variation in my work, but I also miss out on some of the CH activities which is a pity.

Most of you probably already heard about 'De Delftse Bedrijvendagen' (DDB) or will hear about it when you are approaching the end of your Bachelor. The best known event of DDB are the Presentation Days, which are held in February and where 126 companies and over 2800 students gather in the TU Delft Aula Congress Centre for Delft's biggest career fair. Organizing a career fair of this size provides a lot of work, especially when you consider that the organization is only done by ten students. The Presentation Days were a great success and definitely one of the highlights of my year as a board member!

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What some people don't know, is that DDB organizes a lot more than just a career fair. We try to help students in every phase of their career path and therefore four events are organized between February and May. The first event is the Application Training, where students can learn about the best way to apply for a job and can have their résumé checked by professionals. After these trainings, students are able to orientate at the Presentation Days and to get to know as much companies as possible. This global orientation can then be specified during the In-house Days, where interested students can actually visit the companies at their office. The Interview Days are the last event of DDB and give students the opportunity to talk one on one to employees, which, for some companies, can also be the first step in the application procedure.

By the time you will be able to read this column, my DDB adventure has come to an end and all events will be in the past. But while writing this, we are still busy with the last preparations for the Interview Days. About 400 interviews with over 30 companies need to be scheduled which leads to a gigantic logistic puzzle. A nice challenge to solve for this last event!

Furthermore there are a lot of upcoming activities in this last quarter, to which I am really looking forward! The CHoCo will organize the Parent's Day where all first year students can show their parents around in our faculty, but also in the city centre of Delft. All the iCom participants will leave us for one week to learn about and explore Dublin (and of course its famous beers). The AnnuCie will finally be able to present their classy yearbook after months of hard work. And last but not least, the LANcie will organize the hottest gaming event of the TU Delft, which promises to become a spectacular weekend!

The approaching end of this year also means that I am approaching my 'normal' student life again. I think it will be weird not going to CH every day of the week, but fortunately I have learned a lot of things thanks to my board year. In the upcoming months I need to figure out which subjects I want to follow during my master Applied Mathematics. Besides this I will spend my free time working on my case study, because I am one of the lucky participants of the Study Visit to Brazil this July!

Also, there are all the things I have been postponing during the year, that now really have to be done. Combining these with all the upcoming holidays and activities, it makes you realize that the time to sit back and relax has not yet come. We still have a lot of things to look forward to and not much time left: Board 59 won't be bored these last months! 🍷



Help! The super bugs are coming!

Fred Vermolen

Insects are scary but fascinating creatures to most people, whereas in some countries insects are consumed for nutrition. One could ask him/herself whether it is possible to have insects that are as large as dogs or even humans.

Many people are scared or at least disgusted by most insects. In particular wasps, bumblebees (Dutch: hommels) and bees are unwelcome guests during a summer picnic. These nasty animals are attracted to our food, in particular sweet stuff (bees), meat (wasps), and even beer (wasps), and with this last delicacy it is most unpleasant. Furthermore, the unwelcome guests can turn aggressive and use their ability to sting. Ants are considered to be clean and hard-working (like bees), but even they annoy us during a nice summer picnic (and they like beer, I tried it). Last but not least, I should mention the family of butterflies and crickets that are, respectively, very beautiful and known for their nice sounds.

Nowadays, there seems to be a tendency to eat insects, which has been common for centuries in some regions in Africa and Asia. In particular, grasshoppers are consumed in hot chocolate sauce, just like a *fondue*. Even in the Netherlands, some shops offer mealworms for consumption. During one of my holidays in Sweden, I ate ants, and in particular those ants that live near pine trees have a very good sour taste. You only have to be careful to pick the right ant species. In countries like Colombia, roasted (green) ants are a very popular meal. In my opinion, the consumer should shift its culinary attention to insects since they are rich in proteins (hence very nutritious) and thereby they provide a good food source in a sustainable world that becomes more and more populated.



Figure 1: A picture of a bug with an almost cylindrical body.

Then the question emerges whether it is biologically possible to have larger insects. I am not an expert in insects, but it is well-known that insects do not have lungs. They 'breathe' through small channels, or *pores* all over their bodies. One could assume that *diffusion* determines the transport of oxygen and carbon-dioxide through their bodies. Furthermore, their surface area determines the magnitude of oxygen influx and their physical activity is responsible for the oxygen consumption. The consumption rate also depends on the availability of oxygen. If diffusion is assumed to be an infinitely fast process such that the oxygen content is distributed homogeneously, then one can postulate the following equation for the oxygen concentration c in the insect:

$$V \frac{dc}{dt} + V\lambda c = \kappa A(c - c^*), \quad (1)$$

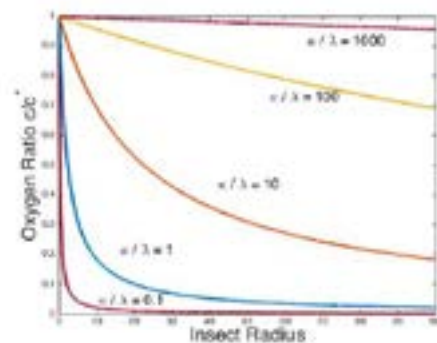


Figure 2: The ratio between the oxygen concentration inside the bug and the oxygen concentration in air as a function of the insect size (radius) for an aspect ratio of four.


where V , A , λ and κ , respectively, denote the insect volume, insect surface area, oxygen consumption rate parameter (which is a measure for its activity), and the oxygen flow rate through its surface. Furthermore, c^* denotes the outside oxygen concentration (that is, in air). The above equation is supplemented with an initial condition, however, noting how the bug grows (as a larvae), we will not consider it. The stable steady-state solution of the above equation is given by

$$\frac{c}{c^*} = \frac{\kappa A}{\lambda V + \kappa A}. \quad (2)$$

This equation is important! It will determine how much beer can be consumed by the insect! Given that inside the insect, a certain minimum amount of oxygen, say θ , is necessary for its survival, then one infers

$$\frac{\theta}{c^*} \geq \frac{\kappa A}{\lambda V + \kappa A}. \quad (3)$$

The above equation can be applied to any type of bug, so let us call it the bug equation. Imagine that the body of the bug is cylindrical (see Figure 1) with a certain aspect ratio (length/radius), then one can derive an equation for the oxygen concentration versus the bug radius. From this relation, the plots in Figure 2 can be made (one can also derive a direct criterion for the maximum bug-size, try this at home?). One immediately sees that the oxygen concentration drops rapidly with the bug radius. This clearly implies that the bug size is limited (under the assumptions made), and hence (fortunately or unfortunately) bugs (like ants, mosquitoes, bees, ...) cannot grow into monstrous proportions, unless the outside oxygen concentration would be much higher than presently on the planet. Since in ancient times, the oxygen levels were somewhat higher, the prehistoric large insects could probably flourish in these days. Hence, they will not steal our beer. One could, however, produce them for consumption in artificially high oxygen environments ...

I am sorry that I bored you with this. Now I am thirsty, I wanna grab a beer right now! Cheers – Skål ! 



TU Delft News

Stijn Ruiter

Delft University of Technology is the biggest and oldest Dutch publicly available technical university, established by King Willem II on January 8th, 1842. But what is currently happening at and around the TU Delft?

In this article, we will shortly list the important events of the recent month.

Points for MOOC's

The MOOC's (Massive Online Open Courses) are getting bigger and bigger. A few years ago, nobody thought that these courses were even possible. Today, thousands of people are following them from everywhere in the world. MOOC's are a great way to learn courses at home, even though the course itself is given on the other side of the world. And we're not talking about small courses here, the university is even trying to give students the opportunity to integrate them in their default curriculum, by assigning study points to them.

TUD Rank

Earlier this year, the university already got the Geospacial Research Institute price, and was assigned a 91th place in the Times Higher Ranking. Now, however, it also got a ranking closer to home. Delft University of Technology can be proud of itself, by achieving the 21st place in the Times Higher Ranking of Europe! Not only Delft did great this year, but all Dutch universities. All of them achieved a place in the top 200 of Europe, with the Wageningen University even on a 14th place. Besides this ranking, TUD also got a top 6 place in the World university ranking by Subject for specific fields, being architecture, chemical-, civil- and structural engineering.

New faculty buildings

You wouldn't say so just by walking past the new faculty building of applied sciences, but it was finished in February. The building and laboratoria still need to be furnished, but this is not going to take long, since in September, it will be fully operational. Both researchers and students will study and work on this faculty near Aerospace Engineering. A few months later, in April also the multi-story car park was finished, placed next to the new building. The reason for this were the multiple complains about the lack of parking spaces at the TUD. All this construction begs the question, what will happen to other faculty buildings, for example the EEMCS faculty building.

What students want

Students don't want more college hours, to compensate for the lack of capacity on the faculties. At least, that's what students answered to the poll organised by ORAS. ORAS asked students of different faculties what they miss at their faculty, and what they want to improve. The results are listed below.

The biggest factor that most students stated, is the lack of working spaces, either group or individual. At all faculties, they want an increase in spaces,

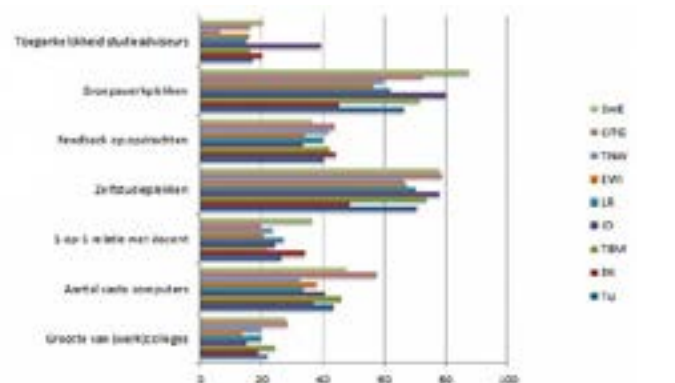


Figure 1: Results Oras Poll

as well as more computers to work on, all though the computers are mainly a concern for master students. The other results concern the capacity of the education itself. There is a lack of teachers, thus less individual feedback. Another result of this are crowded lectures and seminars. TU Delft is already working on improving and fixing these deficiencies by increasing faculty efficiency or rebuilding them.

TU Delft against cancer

Although doctors know a lot about breast cancer and its treatment, the critical factor still remains to determine the cancer in an early stage. Therefore, the EU asked TUD to create a new detection device in collaboration with a few other research facilities

The project HYPMED (Digital Hybrid Breast PET/MRI for Enhanced Diagnosis of Breast Cancer) is a hybrid between the PET technology and the MRI scanner. PET is the part where faculties of Delft are mainly focussed on. It is a method of imaging, where the radioactive particles are measured in the body to reconstruct i.a. tumors.

This is groundbreaking research, since it could increase the chance of cancer being detected in an early stage, as well as making the device more compact and virtually harmless for the body!

References

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SAT solving for dummies

Felienne Hermans

Using computer science for board games is back in fashion since AlphaGo[1] beat Lee Sedol in October last year. While building a neural network by yourself is probably a bit challenging, there are simple techniques you could use if you want to get started in analyzing board games. One that I absolutely love for its simplicity and power is the technique of SAT solving—pronounced “as-a-tee” even though it is not an abbreviation.

The basics

The idea of SAT solving is super simple: given a boolean proposition, find an assignment for the variables which makes the proposition true. For example, consider the proposition:

$$(A \vee B) \wedge (P \vee Q)$$

We could make that one true by (for example) setting A and P to true. This looks like a simple problem, but for general cases it is NP complete, in fact it was one of the first problems to be proven NP complete.

SAT to the rescue!

You might wonder: how will that help me solve any puzzle or game? Well, booleans are a great way to express lots of problems. As an example, consider the famous eight queens problem[2]: how to place eight queens on a chess board without them attacking each other. Could you express this as a Boolean proposition? That would work: give each square a Boolean which represents whether or not it contains a queen, let's call them $A1..H8$. With that we could express that, for example, $A1$ and $A2$ cannot both have a queen:

$$\neg(A1 \wedge A2)$$

Can you finish the rest of the equation?

NP complete, but fast!

So, your problem is now expressed as a boolean proposition, how will that help you? Despite the fact that the problem is NP complete, there are tools that solve it very very quickly. There are a few reasons for that. Firstly, as explained above, boolean satisfiability is one of the oldest NP complete problems, and it makes a very good intermediate problem, hence a lot of research effort has been devoted to it. There is even an annual competition for SAT solvers[3].

Number puzzles

Apart from things that are by nature boolean, like chess fields containing or not containing a queen, we can also use booleans to represent integers, simply by using binary numbers. For instance, suppose we have a number x , and we want it to be smaller than 9. We represent it with 4 Booleans: x_0 to x_3 , where x_3 is the least significant bit, so $x = 4$ would be represented as false,

true, false, false for $\{x_0, x_1, x_2, x_3\}$. Expressing that it is smaller than 9 is relatively easy. Either it is 8, and in that case x_0 will be 1 and the rest is zero, or x_0 is 0 and then we do not care about the rest of the bits, as the result will be smaller than 8 and thus also smaller than 9. In an expression:

$$(x_0 \wedge \neg(x_1 \vee x_2 \vee x_3)) \vee \neg x_0$$

With this, you can use a SAT solver to solve Sudoku and Kakuro puzzles!

A more complex game

Recently, I used an SAT solver to solve a board game myself; I was playing the game of Quarto at home. Quarto is a variant of four in a row, where pieces have not one but 4 properties: color, length, shape and form of the top. The objective is the same: get 4 in a row of one property.

We were playing for a while, and in each game either I or my boyfriend won. So we wondered, can this game end in a tie? By representing each square on the field with 4 Booleans for the 4 properties, this can easily be done. You just have to express that in a tie situation, no row, column or diagonal has one of the four properties equal, plus the fact that all pieces need to be different. With that, I quickly found that Quarto can indeed end in a tie. More details on that in this presentation[4].

Do it yourself!

I have a challenge for you! Pick any cool game or puzzle you like, write up the boolean proposition needed to calculate it (or, more realistically for big problems: write a small program that generates it for you) and obtain the result with an SAT solver. The most creative or difficult puzzle or game gets a nice reward from me: a fun board game! On the page of last year's competition, you can find a list of solvers you can use[5].

One more thing!

Almost all SAT solvers out there use the dimacs format[6], which is a very specific way to write down propositions; including the use of numbers for variables and expressing the proposition in the conjunctive normal form. Luckily, there are a few libraries to transform better looking syntax to dimacs, I wrote one for $F\#/C\#[7]$ myself and there are versions for Python[8] or Erlang[9] on GitHub too. Send your cool puzzles to mail@felienne.com to claim glory and a nice price! 🏆

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I'm simply honest about it

ASML campus promoter Menno Gravemaker talks about his special side job

Menno Gravemaker is in his second year of the Bachelor's programme in Electrical Engineering at the TU Delft. And after getting this degree, he wants to get his Master's as well. But not because he wants to spend ages in the academic world. Inspired by the dynamic start-up scene in Delft, he sees his future in business. Hence, he will be focusing on entrepreneurial competence in his Master's programme. Furthermore, he is working on his network and skills as an ASML campus promoter, the link between technology students and the business community.

Menno: "I had a lot of contact with companies during my executive year. I coordinated collaborative efforts and helped organise content-related and social activities for our 700 members. That's how I got to know ASML. It was through my network here at the TU that the company asked me at one point whether I wanted to be a promoter for them, although I think ambassador would be a better word."

Computer revolution from the Netherlands

For those who are unfamiliar with ASML, a brief introduction below. The company manufactures lithography machines that are used for the production of computer chips. Based in Veldhoven, ASML ships its equipment to all the big chip producers in the world, including Samsung, Intel and TSMC. Menno: "ASML is a fantastic and particularly entrepreneurial company. This is the company that makes Moore's Law (twice yearly capacity doubling on chips) possible. You could almost say that it's responsible for today's entire computer/technology revolution. And it's situated in the Netherlands!"

Linking

So much for the sales pitch. Now, what does Menno do for the students? Menno: "I am the link between ASML and the students. Everyone can come to me with all sorts of questions. The point is to find out whether ASML would be a fitting environment for them for an internship, graduation project or job. I give them honest and objective information about this. Thanks to excursions and training, I have a relatively complete picture of the company. That's why I know that ASML offers a challenge for almost every technical discipline. I can also forward complex questions that I cannot answer to the proper people at ASML." Menno's work is of great value; for ASML, which likes to meet enthusiastic technical talent, but also for students, who can perfectly judge whether ASML is a suitable environment for them.

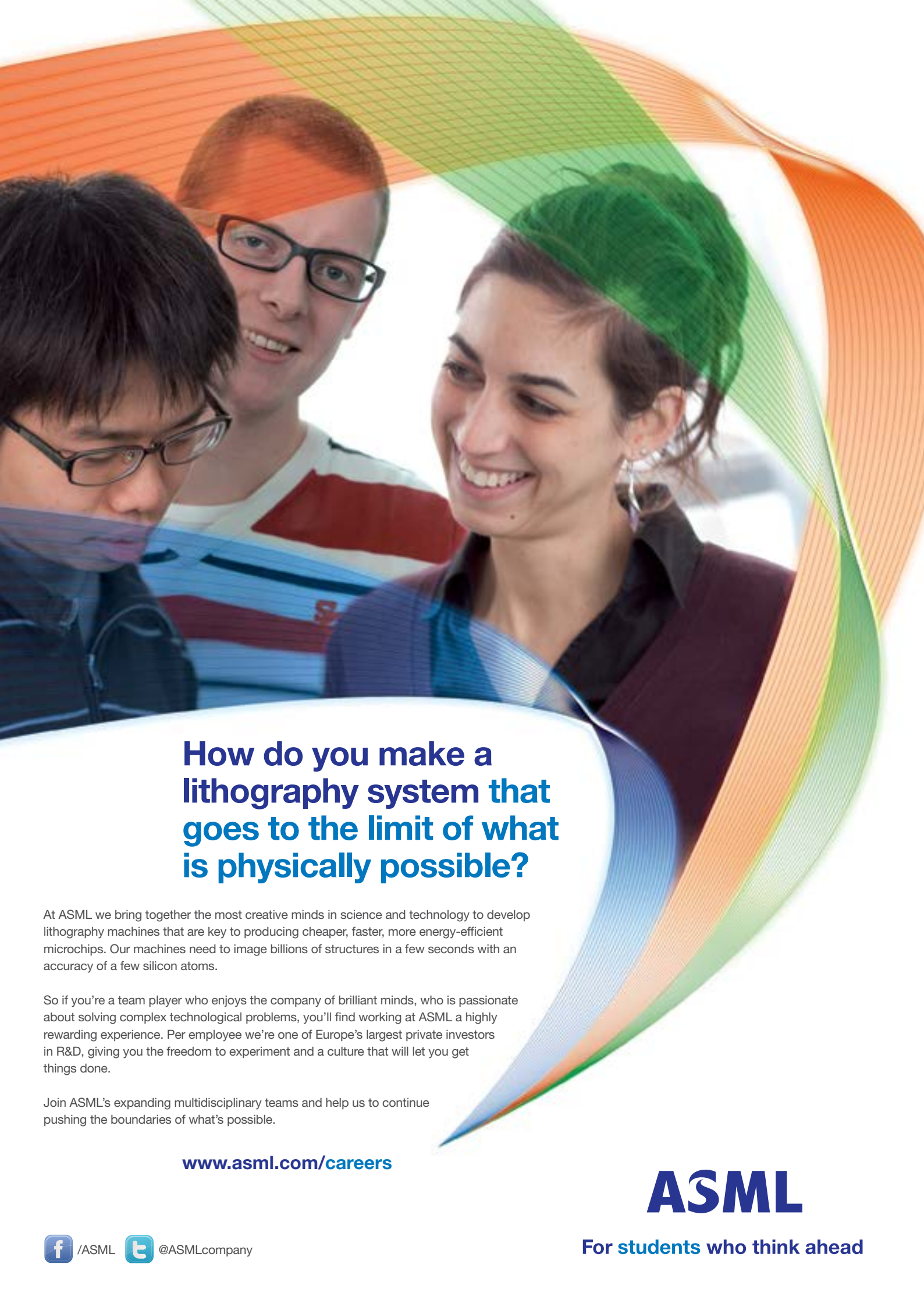
Come take a look

Menno: "My message?" Well, ASML actually sells itself. The company is performing incredibly well. In the latest generation of machines, for example, we use a laser source in order to engrave lines on the chips. To make these lines even smaller, the laser goes through a mist of tin drops. This, in turn, emits beams of light with which you can make even smaller details (up to 13 nanometres). Just imagine! In addition to being technically unsurpassed, ASML is also a very creative environment. So I would say: Come take a look at ASML!"

Want to know more?

Menno, aka the ASML man, is easy to recognise by his ASML jacket and bicycle. Go ahead and talk to him - he's open to all your questions. You can also email him at: mennogravemaker@gmail.com

www.asml.com/students



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For students who think ahead

Calculus MOOC

Ingrid Vos

EdX is an online platform like Coursera that offers courses from different universities. These courses are called Massive Open Online Courses.

People from all over the world can enroll in these courses.

EdX started the high-school initiative: 'We want to bridge the college readiness gap – the difference between what you learn in high school and the knowledge you need to succeed at college and university.' TU Delft won a grant from edX to develop the Pre-University Calculus course. In this article you'll get insight in the creation of this MOOC and the results.

Content first!

The reason to write the proposal for this MOOC was a problem that occurs in many engineering studies: the first-year's calculus courses have a relatively low pass-rate. In fact, many prospective engineering students are not sufficiently aware of the fact that if you finished high school with a low grade for math, you are going to have a hard time, no matter what engineering study you choose.

With this MOOC, we wanted to create a "summer-school"-style course. It provides an explicit review of the topics in high school mathematics that we expect students to master before they come to the TU.

After the grant was awarded a team of teachers was formed to create the MOOC in September 2014. The team consisted of TU Delft teachers Bart van den Dries, Fokko van de Bult, Wolter Groenevelt and Roelof Koekoek. Wim Caspers, a high school teacher who also teaches didactics at the TU Delft helped the team to create the programme of the MOOC.

Finding the right content for the MOOC was a challenge. The aim is to give review of high school mathematics, but internationally, there is a lot of variation in the high school curricula. We decided to start with the Dutch situation and to adapt the course in reruns based on feedback. The main topics of the course are: functions, equations, differentiation and integration.

The course set-up

Nelson Jorge (e-learning developer) and Ingrid Vos (project manager) joined the course team. They organised a brainstorm to think about the course set-up. The brainstorm was organised around three targets we wanted to achieve with the course:

- teach best way to solve problems,
- keep students motivated to finish course,
- help students adapt to new academic environment.

The brainstorm resulted in ideas like: 'Catch the error' videos, interactive exercises, start each topic with a video explaining how the topic is used to

solve real-world problems and a Student Life section to discuss new aspects of student life like planning, making new friends, and combining study and leisure. Based on the results of the brainstorm a detailed course set-up was made and three teaching assistants were hired to help with the creation of the course: Mijke Carlier (Master student), Pascal de Koster (double Bachelor student) and Esmée Vermolen (Bachelor student).

Creating the content

A tip from other MOOC course teams was to start with the creation of the last weeks. The reasoning being that you learn a lot during the creation process and you want the first weeks of your course to be the best. Each week consists of about 10 videos, exercises and homework questions. We had to learn to work with the edX platform and encountered quite some problems to let students enter mathematical expressions. Each teacher wrote scripts for several videos. Those scripts were reviewed together with the teaching assistants. After the script was ready, slides were made and the recordings were done in the New Media Center studio of the TU Delft. After finishing the material for the last weeks we invited students from nearby high schools to come to the TU Delft to give feedback on the material. This helped the course team to improve certain things, also for weeks 1 to 4. With students of the Nuon Solar Team we developed a nice promotion video.


Running the course

One week before the official launch date, we released "Week 0"; students were introduced to the course team, could introduce themselves on the world map and could get used to the EdX platform. We sent stroopwafels to 10 students with nice introductions. The course ran in July and August, but students could finish until the end of September.

A very nice feature of the course is the Course Forum. Here, students from all over the world get in touch and discuss the content and exercises. The forum was moderated by the teaching assistants. However, some of the participants were so active in providing answers and (good) explanations, that we promoted them to Community TA. One of them, Bart de Koning, is now a first-year Bachelor mathematics student in Delft. In December 2015 a so-called self-paced version of the course was opened, meaning that participants completely determine their own pace, with minimal feedback and interaction from the course team. This version will run until the end of May 2016. At June 28th 2016 the new summer version starts. The course team will add some material to the course based on student feedback.

Results

27.186 students enrolled in the first version of the course, and another 9663 in the self paced edition. In total, 182 countries were represented, but most students come from the USA (26%), India (9%) and the Netherlands (9%). Of all TU Delft students that started in September 2015, 19% enrolled for this MOOC. Of this group, 5% obtained a certificate.

In April of this year, the Pre-University Calculus MOOC received an Open MOOC Award for Open Education Excellence from the international Open Education Consortium, praising its "exemplary quality in its presentation of educational content, in breadth, depth and creativity". A very nice recognition of our efforts! 

Enroll now: www.edx.org/course/pre-university-calculus-delftx-calc001x-0

Videos are available via: math-explained.tudelft.nl



Association
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AnnuCie
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ParentsDay
Brazil
SiblingsParty
12thOfTheMonth
Lustrum
Reis
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LuCie
FPS
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AnarCHy - Dies 2016

Arthur Breurkes

March 14, 2016 – “The yearly purge has commenced.” It was time to celebrate the Dies Natalis of our study association. With “AnarCHy” as this year’s theme and gold as its color, the Dies committee had prepared an escalating week for all members. It was time to purge.

Starting on Monday morning, at eight o’clock in the morning, all participants of the assassin game, this year’s continuous game, got their targets assigned. It was now their goal to assassinate as many targets as possible. However, it was not as simple as it may sound. No, the targets must be assassinated at a specific place or with a specific object, which could sometimes be a really tough challenge to handle. For example, how do you explain to your target that you’d like to take a picture of them on the 20th floor of the faculty? Exactly, nobody is probably going to buy that! Please note that the assassinations were not supposed to be real; nobody was actually harmed during this year’s Dies week.

As is tradition, the week opened with the Dies-opening, -reception and -dinner. Professor Aarts presented Christiaan Huygens’ achievements of the year 1659 and Daan Rennings awarded the new members of merit with their official certificates. To celebrate this official opening of the week, everybody was welcome to have a drink and congratulate this year’s board on the Dies Natalis of the study association.

So far, we’ve only covered the traditional opening of the week, but the real adventure had yet to begin. We, the Dies committee, found it useful to teach the members of our association how to find their way out of every kind of difficult situation. This is why we organized a trip to the bouldering center Delft, where we learned how to literally climb our way out of gnarly situations. Only the toughest and most agile people could climb the extremely difficult paths. But the rest had not to worry, there was a huge range of difficulties in climbing paths so no one had to miss out on this intense climbing session.

Now, it would’ve been unwise to kick this session off without having had a good meal such as a member’s lunch with an anarCHic twist: “The worst kaas scenario” (worst case). This wasn’t your regular member’s lunch, no, this member’s lunch had luxurious hot dogs with melted cheese and fried onions. If that wasn’t enough for you, they were served on an all you can eat basis. Believe me when I say that all of the calories consumed during this member’s lunch were burned off during bouldering. It was long survival-training day.

The day after that intense day, Wednesday, people needed a day to recover from their training. It was time for a lecture on AnarCHy. Dadara, a renowned artist, came by to teach us all about AnarCHy as a lifestyle. He taught us how to make decisions in life and make the most out of it while you still can. The lecture was funny and inspiring at the same moment. Correct me if I’m wrong, but I believe none of us would have ever imagined how living like Dadara did could be doable. I mean, basically all he did was make something cool, show it off and then burn it to the ground. It sure sounds cool, but it’s very unlikely to make any money to live from. Well, Dadara actually managed to pull it off and to feed his family. I guess that’s one of the most inspiring things about him. If you really want something, you can pull it off.

I also do believe that motto lived on through the traditional cocktail night later that day. At first, this may sound really strange, but I’ll explain to you why. Every year, the Dies committee organizes a cocktail night in the /Pub and every year the cocktails are sold out very quickly. This year was like all priors, except we were sold out on all cocktails even more quickly. Yes, we sold five hundred cocktails in just under one and a half hours. This sales pace was a well-set record and a good reflection of how successful this cocktail night was!

A good cocktail night usually comes with an unavoidable, “good” hangover. Luckily for those who had a hangover, we organized breakfast with some very tasty paninis and juices. All the hung over attendants got a sudden smile on their face while enjoying their meals in the beautiful sun.

Their smiles got even bigger when they were given the opportunity to bring up the escalating artist inside of them at the graffiti workshop. It was time to teach all participants how to profile themselves using spray cans. We had hired



a graffiti professional to host the workshop. Thirty minutes into the workshop, you could see some great artworks rising up. Most of them were abbreviated names, but some of them were very abstract and colorful scenes.



After learning how to visually profile ourselves, the vocal cords had to be trained. How else could we ever be able to profile ourselves at the excursion later that week? We wouldn't, which is why breaking all glass inside the pub at the helium karaoke seemed like a good idea. Don't worry, we didn't actually break the glass, but we surely laughed our bottoms off that evening and everybody got along like a real family.

Finally, on Friday, it was time for the excursion. With a select group we set off for Utrecht to fill the streets with AnarCHy. We all had to show Utrecht what our association is really made of. And so we walked the streets of the rival city with our golden vests on.

To get a good overview of where in the city we could best show ourselves off, we climbed the Dom tower. The tower is just 20 meters taller than our faculty building (EEMCS), but unfortunately for us, had no elevators. We had to walk the stairs all the way to top. On our way up we come across all sorts of cool rooms. For example, we saw the location of an old medieval pub inside the tower. Because of the restrictions in that time, the pub's visitors had to climb a rope ladder up to the pub in order to get in. You could imagine that giving difficulties for all the drunk people at that time. Let's at least conclude that some of them didn't really know how to climb a ladder anymore.

Once we had climbed all the way to the top, we could see all of Utrecht. Quickly, Erik had spotted the location where we should and could really profile ourselves: City brewery Oudaen. What's more, the building of the brewery turned out to be the old fraternity of student association Veritas. Now what could possibly be a better place to profile ourselves than in a building like that? Exactly, it was perfect.

We quickly descended the stairs back to ground level and proudly walked the city streets to the brewery. Once there we were shown around and given some very tasty specialty beers. It was amazing to see how the beer was brewed on



location and in the traditional way. For aesthetics, the brewery's kettles even have copper outer shells, so they seem old. You might think they're just faking it, but I must say the beer tasted really good.

However, to be able to taste all the beers they had, we all needed some proper food to make for a good layer of alcohol resistance. Luckily for us, Oudaen also served food. To be honest, the food they served was pretty fancy and thus a very suitable meal to conclude this year's Dies week.

In conclusion, I think it's safe to say this year's Dies week has been a great success. It was amazing to see the amount of enthusiasm all participating members of our association put into the week. So, there's only one thing I've got left to say: The yearly purge has concluded, thank you for participating! 🍷



Lustrum Update

Felix van Doorn

With every new edition of the MaCHazine, we are edging ever closer to the start of the Lustrum year! Since our previous article, we have been very busy with organizing all kinds of fantastic events for you to enjoy during the next academic year. It's safe to say that things are #Trending in the right direction!

To get all members of our amazing association even more excited for the Lustrum, we have also organised some events for you to enjoy in the current academic year. By now we have already unveiled the Lustrum theme and we have held our first '12th of the month' activity! Many of you took a well-deserved break from your studies and enjoyed free #Trending cupcakes! We were very happy to see that so many of you showed enormous appreciation for Saskia's amazing cupcake baking skills! Pay close attention to your calendars (and Facebook), so that you do not miss the next '12th of the month' activities! We'll be waiting for you at CH with our next surprise!




As many of you know, we will be hosting one large event during this year. Our very own Lustrum Beer Cantus! For those who have never been to one of these or have never even heard of a Beer Cantus, we will briefly explain what you have been missing out on.

As you might know, Cantus is Latin for song. From this we can infer what a Beer Cantus is basically about: Beer and singing. Usually, you are given a glass (or in the best case a tankard) upon arrival at the event's location. You then go and sit down at a table and beer will be brought to you! Tradition dictates that the beer should be poured from a watering can, so some spilling will be involved.

You will get free refills during the course of the event! From here songs will be sung and memories will be made, but not necessarily remembered. From here the organisers of a Beer Cantus are free to enforce some special rules of their own. Sounds like an excellent way of spending time with fellow students, doesn't it? In our specific case, we have live music played by Das Band. Our Beer Cantus will be held on 30 May from 16:00-18:00!

As of now, the Lustrum Committee is working on finalising the programme for next year. Some of the activities are still subject to change, but we can reveal things about some of the larger activities! The opening of the Lustrum year will be a festive event in itself, speaking of hit the ground running. At the moment, we are working on a Lustrum lecture with a very special guest. Apart from food for thought, we will also supply you with actual food at our winter BBQ!

We can't exactly go out an honour ancient Roman Lustrum traditions by sacrificing animals, but a BBQ is close enough and somewhat more animal friendly. Apart from all the delicious food, we will be surprising you with a very special surprise act. In the next quarter, there will be a Lustrum Gala of course! Currently, we are working on a number of gadgets that will be of great use for this evening. In the third quarter, the traditional Dies week will be supercharged for a more #Trending edition. In the last quarter of the year, we will not be slowing down. This will be highlighted by one of the activities that we are exceptionally excited about, our very own Hackathon! We are already excited about what you guys are able to create together in under 24 hours! Remember, this activity is more about having good ideas than being a fantastic programmer. So don't feel that this activity is only interesting for Computer Science students! This epic year will end with a bang at our closing party.

There are still many more activities that we are working on, keep your eyes peeled for the finalised schedule. The Lustrum Committee is already really excited to organize all these amazing activities for all the members of W.I.S.V. 'Christiaan Huygens'. We take a lot of encouragement from the enthusiasm all of you have shown during the few activities we have already had! Our objective is to keep that trend going! 



Parents' Day

Ruth Korthals Altes

A few months ago, more than 300 bachelor freshmen students started their new studies. Every time they visit their parents, they tell them all kinds of stories about the city of Delft, about their studies and for some also about their fraternity or sorority life. A couple of weeks ago, on April 23rd, it was time for their parents to see everything with their own eyes during Parents' Day. 250 Parents, freshmen and some brothers and sisters came from many different places to the faculty of EEMCS early in the morning for a day filled with fun activities in both the faculty and in the centre of Delft.

Preparations

More than half a year ago, we started with the preparations of the Parents' Day. Finding the perfect date (which seemed easier than it turned out to be), finding teachers for the lectures, making sure there were touring boats available and that the day would run smoothly. And, of course, the necessary promotion in our blue sweaters so that enough people would apply. Actually, applications still came in the evening before the Parents' Day.

The day itself


The first parents and students arrived at 9 o'clock in the morning. While the hall started to fill with people, the participants could make up the early morning rise in the weekend with a cup of coffee or tea. In some cases, you could see the family connection between the parents and the students (or, in some cases, if you asked if someone was a twin brother or sister that person could give an angry look at you because he or she was three years younger). After the welcome speech, the students of Applied Informatics and their parents started off with a trial lecture given by Felienne Hermans, while the students of Applied Mathematics got a tour through EEMCS given by a member of the CHoCo committee and someone from the board of Christiaan Huygens that was followed by a lecture from Joost de Groot about coding techniques. The most special part of the tour through the faculty was definitely the so called 'Studieverzameling', which contained all kinds of old devices like radios, television sets and communication equipment. Even though it has been in EEMCS's basement since the opening of the building in 1969, most of the (freshmen) students did not know of its existence. One of the other things that were included in the tour was the roof of the building, where the students had been for the last time during the EJW. On the roof, the parents were surprised by a beautiful view that reached from the dunes to Rotterdam where the angry

clouds luckily passed Delft, so that everyone had a nice (and dry) view over the campus and the centre of Delft. Even though we had advised everyone to bring an umbrella because of the weather forecast that said it would be a rainy day, we luckily did not have to get them out of our bags.



After the lunch with the 'broodjes Leo' (very well known to the students), we walked in a big parade as foreign tourists to the centre, where we divided the group in two parts. Both groups went separately on a tour on a boat through the canals and the Nieuwe Kerk, where some of us had been earlier that week to collect some information about the church that we could pass on to the parents, and apparently we came across as real guides. At least, looking at the number of people that were following us that did not belong to the Parents' Day. We ended the day as a matter of course in the /Pub, where a few students and their parents participated in the pubquiz, which could easily be done if you paid good attention to the tour through the canals and the church, and where we discussed the day with some parents while enjoying a beer or two.

Overall, we thought it was a very nice and successful day and we know the parents thought the same. At least, the ones we spoke to all said that they really enjoyed their day and we even received a few emails from parents that had to leave early but still wanted to say that they really enjoyed their day.

While we are preparing the last few things for our next activity, the Brother-SisterParty, we can look back on the Parents' Day with a positive view and we hope that next year's freshmen can show their faculty and the city to their parents and other family members on next year's Parents' Day with similar enthusiasm. 



Delfteriken & De grootste telefoonwinkel van Nederland

De geschiedenis van Mobiel.nl begint in het jaar 2000, wanneer de Delftse studenten Thomas Borsboom, Lucas van Reeken en Jules Koekkoek Studentmobiel oprichten. De studentenkamer van Jules fungeert als kantoor, van waaruit met een computer en een fax het bedrijfje wordt gerund. Filemaker Pro wordt gebruikt als basis voor het klantenbestand. Dit bestand moet natuurlijk gevuld worden. Daarom nieten de mannen met de ov-jaarkaart op zak en op guerrilla-achtige wijze alle kantines, fietsenstallingen en computerzalen van Nederlandse universiteiten vol met flyers. Vaak tot woede van conciërges en kantinedames. Deze marketing blijkt echter effectief: het aantal klanten stijgt en de hoeveelheid werk neemt toe. Jules en zijn vriendin worden op zondagochtend steeds vaker uit bed gebeld door klanten. De studentenkamer wordt daarom al snel ingeruild voor een "echt" kantoor, een piepklein hokje in een bedrijfsverzamelgebouw vlakbij Den Haag Holland Spoor.

In 2003 verhuizen ze naar Scheveningen en maken de flyers langzaam plaats voor een meer volwassen vorm van marketing: online advertenties via onder andere Google en stevast de voorpagina van de Metro en Spits. De oprichters studeren af in 2004 en in 2005 wordt Jules uitgekocht. Datzelfde jaar nemen Thomas en Lucas de eerste fulltime medewerker aan. Naast een telefoon geeft Studentmobiel ook veel andere producten weg bij hun abonnementen. Dit blijkt een succes. Het magazijn puilt uit van de mountainbikes, home cinema sets en laptops. Ze barsten regelmatig letterlijk uit het kantoor, dus worden de verhuisdozen ingepakt en naar Nieuwstraat 16B in Leidschendam gebracht. Dat jaar realiseert Studentmobiel een groei van maar liefst 150%.

Martijn van Leeuwen, de huidige Lead Developer, maakt vanaf 2006 deel uit van het team. Het offline Filemaker wordt al snel ingeruild voor een echte database, waarmee de basis is gelegd voor het huidige platform: een eigen ontworpen uniek systeem waarmee de bedrijfsprocessen van bestelling tot en met de levering volledig worden beheerd. Daarnaast wordt ook de eerste grote slag geslagen met de digitalisering van de steeds groter wordende stroom documenten. Dagelijks bezorgt TNT Post immers zakken vol contracten, legitimatiebewijzen en bankafschriften van klanten.

Gedurende de tijd dat IT bij Studentmobiel een one man show is, wordt Martijn op vakantie regelmatig van zijn fiets gebeld om vervolgens vanuit een internetcafé een bedrijfskritische bug te fixen. Inmiddels bestaat het IT team uit negen developers, waarvan bij sommigen de inkt op het diploma net is opgedroogd en een aantal met flink wat IT-jaren op de teller.

Waar providers zich onderling

zoveel mogelijk van elkaar proberen te onderscheiden, wil Studentmobiel het de klant juist zo makkelijk mogelijk maken om de verschillende abonnementen eerlijk met elkaar te kunnen vergelijken. Om dit te bereiken worden aan de achterkant miljoenen prijspunten verzameld en aan de voorkant overzichtelijk weergegeven.

De Blackberry's, Nokia's en iPhones vinden steeds gretiger aftrek en in 2011 verwelkomen Thomas en Lucas de 500.000e klant. Naast klanten verwelkomen zij ook steeds meer nieuwe collega's, waardoor Nieuwstraat 16B noodgedwongen wordt uitgebreid met 18A en 14C. Jaar na jaar realiseert Studentmobiel groei, in 2013 (nauwelijks twee jaar na de vorige mijlpaal) plaatst de 1.000.000e klant zijn bestelling. Begin 2014 worden de drie panden ingeruild voor het huidige pand, wederom aan de Nieuwstraat maar nu nummer 22. Een heel volwassen locatie met meer vergaderzalen, een groter magazijn, een heuse kantine én een prachtig servicepunt waar klanten persoonlijk geholpen kunnen worden.

In 2015 wordt groots gevierd dat Studentmobiel 15 jaar bestaat, is de 1.500.000e klant een feit en kan Nederland door al het mediageweld definitief niet meer om Studentmobiel heen. De hoogste tijd om het succes te vieren en opnieuw de stap naar het buitenland te maken! Na eerdere uitjes naar Sölden en Winterberg, neemt het hele team in één weekend Parijs over. Het bedrijf groeit nog steeds hard. Naast teams uitbreiden met nieuwe gezichten is het belangrijk en vooral ook heel leuk dat medewerkers meegroeien. Veel collega's die tijdens hun studie begonnen zijn op de klantenservice of orderadministratie, zijn doorgesloopt naar functies in marketing, financiën of IT.

Begin 2016 vindt misschien wel de grootste verandering plaats. Thomas en Lucas tekenen voor de overname van het domein Mobiel.nl. Hetzelfde bedrijf maar met een nieuwe naam en een nog grotere ambitie om de klantverwachting te blijven overtreffen. Bij grote ambities horen grote plannen, zowel strategisch als technisch. De backlog staat tot en met december vol met vernieuwende onderwerpen. Het team wordt regelmatig uitgebreid met developers, designers en diverse andere functies om alle plannen te realiseren.

Naast hard werken houden de collega's van Mobiel.nl ook van met elkaar proosten op het weekend. Daarom opent Café IT iedere vrijdagmiddag haar deuren. Kom gerust eens langs voor een biertje!



Van 1-1 naar n-n; volwassen worden tussen de code

Door Martijn van Leeuwen

Net als een jonge organisatie groeit ook de code soms hard en onstuimig. Het proces van start-up naar volwassen bedrijf is hier ook van toepassing. Je start als kleine club met een enkele ontwikkelaar die de eerste periode in z'n eentje verantwoordelijk is voor het grootste gedeelte van de code. Binnen het bedrijf is alles gericht op groei en er zitten niet meer dan 24 uren in een dag. Daardoor moet er snel versterking gezocht worden. Langzaam maar zeker werken er steeds meer mensen aan je project. Dan kom je erachter dat samenwerken in één code base weer nieuwe uitdagingen met zich meebrengt en dat de code die jij zelf hebt geschreven toch minder briljant is dan je aanvankelijk dacht. In je nieuwe, frisse project verschijnen kleine haarscheurtjes en zonder dat je het door hebt is er ineens sprake van legacy code. De groei blijft en tijd voor refactoring is schaars. Inmiddels ben je een aantal jaren verder en neemt je productiviteit en flexibiliteit af. Voor veel bedrijven is dit een bekend scenario en voor ons bij Mobiel.nl niet anders. Hoe kun je dit proces keren en je applicatie weer lean en mean laten zijn? We hebben een aantal praktische punten onder elkaar gezet.

1. Go, with the GitHub flow

Door elkaars code te beoordelen en de wijzigingen op de master branch klein te houden gaat er nooit ongezien code naar productie. De code wordt gecontroleerd, automatisch schoner en iedereen kan van elkaar leren.

2. Pragmatisch, Lenig en Kort

Door te werken in korte cycli van twee weken kunnen de ontwikkelaars zich hoofdzakelijk richten op de lopende periode. Wij hebben gekozen voor de Kanban-methode om zo een breed mogelijk scala aan verschillende onderwerpen goed te kunnen behandelen. Naast het Kanban-team draaien we voor een aantal speciale projecten aparte scrumteams. Pik uit de verschillende methodieken wat nuttig is, en laat het systeem voor jou het werk doen.

3. Inzetten op Software Craftmanship

We proberen ons te richten op de groei en ontwikkeling van de ontwikkelaar. Daarbij geloven we niet in de enterprise-gedachte met zijn certificaten, maar juist in de kwaliteit van de individuele ontwikkelaar. Een goede developer kan en moet meer zijn dan een code-klopper.

4. Kleine testjes, grote testjes, maak een grote testmachine

Wij willen de werking van onze software waarborgen door hiervoor unit en integration tests te schrijven. Over het algemeen geldt goed testbare software = goede software.

5. Alle tests groen? We kunnen een release doen!

Als je vertrouwen hebt in de testsuite en beschikt over een goed ingerichte deploy-straat kun je dagelijks zo vaak releasen als nodig is. Op deze manier kunnen verschillende teams of ontwikkelaars veilig aan dezelfde applicatie werken.

6. Own your product

Hoe groter je bedrijf wordt hoe meer input je developers krijgen. Om dit goed te laten verlopen is het aanstellen van Product Owners belangrijk. Een Product Owner creëert rust, zorgt voor focus en schept de juiste verwachting naar de buitenwereld.

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Study visit 2016 - Brazil

Tom Brouws

Since the last article on the Study Visit in the MaCHazine, a lot has happened. To name a few things, we opened the registration, selected participants, received a 'Go' from the General Assembly and started with the preliminary program. If you're interested in reading more about what happened, you're in the right place! I'll give you a quick outline of the past few months and look ahead to the future, with many great things yet to come.

As you may know, an important part of organising a CH Study Visit is the 'Go/No-go'. This event takes place during a General Assembly, where members of CH decide if the committee has made enough progress to ensure that the preparations for the trip are made on time. The current financial situation was presented, our plans for the preliminary program and the trip itself, and the list of selected participants. We've worked hard to reach that point, and received overwhelming support from the people attending the assembly. The 'Go' is a fact!

After the Christmas break we had the official kick-off of the preliminary program, in the form of a get-to-know drink in the /Pub, where all selected participants could meet and get to know each other. We played a game where everyone had to write some facts about themselves on a piece of paper, which were then distributed amongst the group. By trying to find the person to whom the fact belonged, the participants could get to know a bit more about everyone. Since then we've undertaken a lot of activities with the study visit group, such as in-house days to Ordina, QDelft and Flowtraders, a guest lecture by Q42, as well as a Capoeira workshop and a safety training organised by the TU Delft. Let's highlight a few events.

Our first in-house day was at Ordina in Nieuwegein, where we followed an exciting program. After travelling together from Delft, the day kicked off with a short presentation, after which there were three tracks to choose from, each related to an existing Ordina project. The tracks offered hands-on experience with Ordina software, and were a great way to see what kind of technology is used at Ordina. The visit concluded with a short summary of the tracks and some great lunch.

The in-house days in general proved to be a great way for companies and students to meet each other, while giving an honest and inside view of the respective companies. Activities during the days included lectures, talking to employees during their work, case studies and hands-on with the company's

tech. We've received lots of positive feedback from both the companies and participants, and we think in-house days have had great value for the study visit group and for the companies.

As a team building activity we organised a Capoeira workshop, held at Sports & Culture centre, here on campus. Capoeira is a Brazilian sport. It is sort of a mix of dancing and martial arts. We learned a couple of dance moves on traditional Brazilian music, as well as some self-defence techniques used in Brazilian jiu jitsu. Our host also told us a bit about Brazil and gave some tips for our visit. It was a fun and refreshing evening, in which the participants could experience some culture while getting to know each other a little better.

So let's look at the future. As July is getting closer, we're busy finalising the trip schedule, as well as finishing the preliminary program. We still have a couple of events left, including one more in-house days, a case workshop by Shell, a company dinner and another guest lecture. The study visit editorial committee has started working on the design of the booklets we'll be publishing. The program booklet will be distributed before the trip, while the preliminary report and final report are scheduled after our return to the Netherlands.

We have an intriguing trip ahead of us, with many university and company visits already scheduled. During our visit to Rio de Janeiro, São Paulo and Porto Alegre, we'll also undertake a variety of cultural activities. We'll be visiting the statue of Christ the Redeemer, enjoying some traditional Brazilian cuisine, strolling through local markets and go out for drinks in the evenings. We think the program is quite diverse, leaving enough time for culture and nature, both as a group activity as well as on an individual basis. Participants will have all opportunity to have a great new experience, get to know a different country and culture and see how academics and business are handled in Brazil. We're excited, and you'll hear more from us after the trip! 



Freshmen Programming Contest

Stijn Ruiter

Every year, the CHiPCie (CH Important Programming Committee) organises a FPC (Freshmen Programming Contest). This year, the FPC was on March 24, 2016.

As the name already suggest, the FPC is a programming contest for all freshmen in Delft. The goal is to solve as much algorithm and programming problems as possible as the given time of 3 hours. The exercises consist of IO exercises, as well as logical puzzles which needs to be solved fast in order to succeed.



Figure 1: FPC

Prepartions

All though, this event isn't very big, still a lot needs to be done in order to host the FPC.

Jury

First of all, a problem set needs to be made. A great team of jury members each composed an problem for the competition. It's quite a difficult task to create fun and original problems, for the freshmen to solve. There was also an problem, which involved the lessons of algorithm and data-structures. Freshmen who attended the FPC and also solved some problems, could count this as part of the course.

System

Obviously, beside a great problem set, we need a system to program in and submit the solution. This is quite complicated linux system, since it must be possible to solve it in different languages, like java and c++. Only when all the computers in the cubical hall are finally imaged and this linux system is finally installed, the contest can begin.

General

However, with only computers it wouldn't be a nice competition. Therefore, we also organised some helium balloons for every problem that a team solved. Not only is this a fun reward for the hard work, it is only a achievement which can be seen from all around the room.

The best way to think is with food. Therefore, there are also snacks available, namely chocolate easter eggs.

Now to competition can begin!

This year

This year, 14 teams of one to three persons each competed against each other in a nerve-racking afternoon, where the competition was evenly matched. Afterwards, there was an award ceremony, where the best teams earned themselves a Raspberry Pi, after which the day has come to an end.



Figure 2: The ceremony

Other contest

Although the FPC is a great event, with lots of diversity in people and exercises, it's only small compared to the follow up contests. Besides the FPC, there is also an DAPC (Delft Algorithm Programming Contest), which is the same kind of contest as the FPC, but with a more difficult problem set and is also open for every Delft student, thus not only for freshmen.

This contest is merely a preliminary round for an even bigger tournament, the BAPC (Benelux Algorithm Programming Contest), which is on 22 oktober. Normally, this day is held somewhere in the Benelux, but this year, we are organising this event in Delft!

Thus, if you are interested to compete, attend the DAPC this year. 

References

[1] <https://commissies.ch.tudelft.nl/chipcie/>



WiFi Rally

Maaïke Mol

Right after the skiing trip was over, the WiFi started their next adventure. Organising the very first CH Rally ever! It took us hours of searching for awesome destinations in the Benelux, days of making routes on Google Maps and more days of making up the puzzles and placing them in the rally book. It was totally worth it, because in the end all the participants had an amazing Easter weekend.

Saturday the 26th of March, 35 participants and 9 cars gathered at the Drebelweg. They were all ready to leave and determined to win. There were several checkpoints during the weekend, and in order to get to the next checkpoint, the teams had to complete some puzzles. With the solutions they could travel to the next checkpoint and gain points for the general ranking.

The points could be gained by finding letters placed along the correct route and not opening the emergency envelope, which included the address of the checkpoint. If the teams failed to complete the puzzles in time or completely lost their way, they had to open the emergency envelope and travel by GPS to the next checkpoint.

The other ranking was the “eSKIlatie” ranking. Teams could win points by completing many random challenges, for example by making the best team picture, cuddling a cow or filming your team passing another team by car. The rally started easy, the participants had to solve a rebus puzzle to find the first destination and then they could drive there using the fastest route.

The second part of the rally was much harder to complete perfectly. The participants had to stay as close as possible to a border on the map. This border was the Maas, which they had to follow even if this meant driving over unpaved roads or through small villages. Even though some teams only found four of the twelve letters, everybody found their way to Maastricht, where the next checkpoint was.

During the third part of the first day, we finally left the Netherlands and entered Belgium. The participants had to follow a line on the map for the correct route, with the map underneath the line removed. During this route the first emergency envelope had to be opened by a team to find the next checkpoint. This checkpoint was Barrage de La Gileppe, a weir in the Ardennes.

From there we drove together to Circuit Spa-Francorchamps. Here we were supposed to have a BBQ and then leave for the last part of the route to the hostel. Long story short, there were some problems with the BBQ. Luckily after



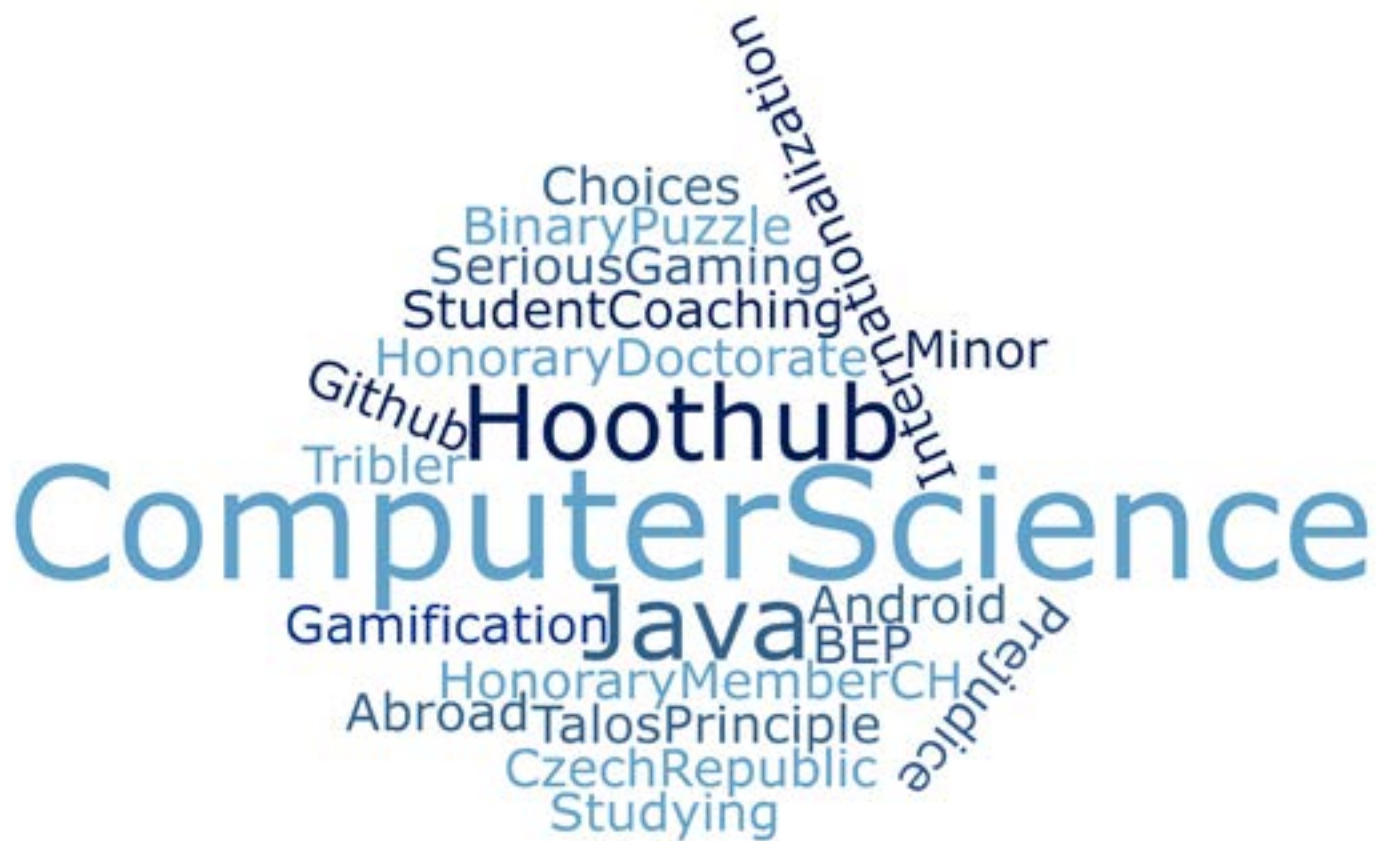
some time everybody had dinner, but unfortunately, there was no time left to do the last “ball-arrow” route. After the BBQ we drove to the hostel. Everybody exchanged their experiences and amazing stories. Most people went to bed quite early, because we needed to be fit again on Sunday and lost an hour due to summertime.

Sunday morning at 9:00 am all teams were ready to continue the trip. The first part, they had to follow the directions of the TomTom or in our case, SvenSven. The directions were written down, which meant they had to count the meters till the next direction and were not corrected when driving wrong. In this route the participants also had to find letters, including a ‘VO. This route led to the next race circuit, the Nürburgring. This racing circuit is famous because it’s very dangerous and there have been a lot of car crashes.

From the Nürburgring arrows on a map lead the participants to a much more idyllic checkpoint; a lake in Nationalpark Eifel. Now, it was time to start the last route. This route was called the women-route because all directions were written down with a lot of useless facts between the directions. For example, the teams had to take the 25th exit at a roundabout. Some participants weren’t so lucky during this route: there were multiple speed trap camera’s on the road and some of us were caught driving too fast.

The last route went to Vaals, exactly to the point where there is a border triangle between the Netherlands, Belgium and Germany. Here the eSKIlatie ranking points were checked and all points were added up, the winners of the two rankings were announced and they received their well-deserved prizes. Finally it was time for everyone to say goodbye and drive back to Delft.

It had been an exhausting but memorable weekend. We as WiFi would like to see the rally become a new yearly activity for CH, because it was an amazing trip!



Interview: Prof. dr. dr.h.c. L.J.M. Rothkrantz

Rebecca Glans

Honorary member of CH since the Dies of 1985, prof. dr. dr.h.c. L.J.M.

Rothkrantz has now received another form of admiration. The Czech

University of Technology, Prague, offered him an honorary doctorate on

the 26th of January this year. A great moment to ask prof. Rothkrantz

about his career and his contribution to various universities both in

research as aiding the students that attend them.

The secretary of the current board of 'Christiaan Huygens', Sven van Hal, and I were given the opportunity to interview this honorable man. The interview took place in his office on the 12th floor of our EEMCS Faculty.

Upon arrival, Sven commented on the lovely view from his office and prof. Rothkrantz was reminded of when the old Architecture faculty had burned down. Apparently, a colleague of his recorded a short video of the starting fire. Colleagues of him working in the faculty at that moment were not aware of the fire until seeing that video. Sven and I were there less than two minutes and we were told story after story about life at the TU Delft years ago.

One answer to rule them all

We prepared seven questions for this interview. That might not seem much at first, but considering all the work prof. Rothkrantz has done the past years and being known as an easy talker, we weren't that worried. What we didn't prepare for, is that he would answer almost all the questions with an extensive answer to our first question. But, hey, what else would you expect when asking "Could you give us a short summary of your career and the choices you made along the way?".

Prof. Rothkrantz was just Leonard Johannes Mathias Rothkrantz when he started studying Mathematics at the University of Utrecht in 1967 and received his doctorate at the University of Amsterdam thirteen years later. Before entering the University of Utrecht, he went into military service for two years. Born in Limburg, you would expect him to study at TU Eindhoven. Because of his "2 left hands", engineering wasn't really an option, so Utrecht was the next choice. He chose Mathematics, because it's a mostly abstract study. Since he lost two years due to his military service, he made sure to complete his study without delay. As the university had no places left, he had to study for his doctorate in Amsterdam. Fortunately, one of his supervisors would be the famous mathematician Prof. dr. H. Freudenthal. Again, due to a staff shortage, he also couldn't stay at this university.

That is how he ended up in Delft, by teaching mathematics at the Nieuwe Leraren Opleiding (NLO), a teacher training programme. He taught there for 4 years until he saw a vacancy for study advisor at the TU Delft.



Career at TU Delft

In 1980, like prof. Rothkrantz, most study advisors were in possession of a doctorate. Prof. Rothkrantz focussed on coaching students. He observed that a lot of students failed or dropped out because they didn't study with other students. He solved this problem by introducing a compulsory "study lab" in the library. He made sure students were studying every evening, without any distractions. They were only allowed to socialize during the breaks. To make sure students attended these evenings, he had arranged for two muscular students to act as officers and told his students "if you're not there, they're coming to get you!". Since presence was mandatory, students could motivate and help each other. Students came in contact with one another, could share study related issues (and more) and find study companions. Besides studying, it were lively evenings. It became a society of some sort; not for partying but for studying. The study lab paid off and to show the student's appreciation, W.I.S.V. 'Christiaan Huygens' appointed prof.dr. Rothkrantz as honorary member during the Dies Natalis of 1985.



In 1992, prof. Rothkrantz sought another challenge, but still wanted to keep contact with students. He became professor at the Artificial Intelligence (AI) department. Back then AI was booming business: “being able to pronounce Artificial Intelligence was an achievement on its own” he commented. Interest among students was huge as well.

Another bachelor, why not?

You would think he was born to be a study advisor, but he didn't know what to expect. With only a doctorate, it was a requirement to take some further training. Prof. Rothkrantz started taking a few Psychology courses at the University of Leiden. And you know what? He found it so interesting he eventually graduated as psychologist in 1980. Studying in Leiden was a whole other experience: most of the students were female. He made the comparison that in Leiden, during workgroups, he would most likely be secretary. “But here in Delft, it would've probably been you!”, he said pointing at Rebecca.

The real reason we're here: Prague

While talking about the many graduates at the AI department – over more than 120 registered – prof. Rothkrantz made a link to his part in internationalization. It all began in 1980, where the discussion started about TU Delft being more than a “local university”. They wanted to attract more international students and sent more of their students abroad. The first contract made was with the Grandes Écoles of France, the elite among the higher education establishments in France. Every spring and fall these universities sent their students to follow courses elsewhere for one week. One of these places could now be the TU Delft. In their turn, TU students would visit Paris for a week. The French received a quite intensive week, beginning and ending with some social activities. Both Paris as Delft were very pleased by the visiting students.

Eventually, the Eastern Bloc delivered students to the TU Delft as well. Many came from Budapest, Bucharest and, of course, Prague. For the students here, Prague was the most interesting to visit as it's a beautiful and lively city – and the beer there is very cheap.

In Prague, our students could very easily arrange their housing. For the visiting Czechs, it was another story. The scarce financial resources of the Technological University in Prague and the big difference in currency didn't make it easy. That's where our thoughtful professor stepped in.

From personally asking students to take in a Czech, to placing his own caravan, and those of others, on the well known Delftse Hout, he made sure they had a place to sleep. He reached out to different people and funds for sponsorships. These he used to arrange food for the international students and occasionally purchasing sleeping bags when they were on sale. It was a lot of hassle for about 150 Czechs who probably had never set a foot outside of their country.

Summer school for internationals

The international students mostly visited during the summer, when they followed a six week program. This often caused some friction in the Rothkrantz household. “I didn't go on vacation for several years. I would therefore always get the comment ‘The Czechs are coming to visit you again, huh?’” the professor said. The students' visit needed to be meaningful, so projects and researchers needed to be available. This was often a problem as not many colleagues were available during the summer. And since many research was already in progress,

students couldn't just join in. One available research project was about face recognition. The students could do all kinds of work in the different labs – which were empty as everyone was on vacation – and use tools they had never seen before.

It were good times as the students knew how to have fun besides studying. Most of these occurred in our own /Pub, starting right after the lectures. Sometimes it got a little out of hand, especially when there were Spanish female students involved. But, as the saying goes “ 's Avonds een vent, 's ochtends een vent” – meaning that if you're man enough to party hard at night, you're man enough to take your responsibilities the next day – , they were all present at their 9 o'clock lectures the next day.

For all his hard work up until that point, the Czech Technical University offered prof. Rothkrantz an honorary medal.


The honorary doctorate

To this day, we can see the result of these summer schools. Many international researchers and even international bachelors are all attracted to the TU Delft due to the successful internationalization. The bond between prof. Rothkrantz and the Czech University of Technology grew as he became guest lecturer and researcher there in 2003. He helped many students, both here and in Prague, to get their doctorate.

It is no surprise that he received an honorary doctorate this January. The traditional ceremony, for which he invited some Dutch colleagues, lasted for over two hours and was held fully in Czech. It was a beautiful ceremony, where professors from each department wore a differently colored robe, forming a colourful crowd.

Retired, but not tired

Since his retirement, prof. Rothkrantz has an employment of 300 hours at both the TU Delft and the Czech University of Technology. Besides bringing in research projects, he also spends his time working on the Massive Open Online Courses (MOOCs). “They had never heard of such a thing in Prague before” prof. Rothkrantz commented. He advised them to develop MOOCs there as well, to attract more international students. “By introducing MOOCs you could also filter out the less qualified students”, making it work both ways. The professor told us that the university in Prague is the only technical university in the whole Czech Republic. For those travelling several hours a day, MOOCs would make a huge difference as well. A group, including himself, is now working on implementing MOOCs for several practical projects. The ideas for these projects include solutions for traffic management in the city and the many floods the country faces.

On behalf of the MaCHazine, we would like to thank Prof. dr. dr.h.c. Rothkrantz for his time and lovely stories, but above all for his efforts for students attending the TU Delft (both national as international) and the opportunities here for Czech students. 



Augmented reality mirror game

Tim van Rossum

At the time of writing, we are already a week into the fourth and final quarter of the year. This means, for most people who want to finish their Bachelor's degree this year, they've started on the final hurdle of the curriculum of the Bachelor this week: the Bachelor Final Project.

The project was an assignment of dr. Stephan Lukosch, a researcher at the faculty TBM, department Multi-Actor Systems, and it was guided by dr. ir. Rafael Bidarra. The general aim of the project was developing a serious game, it has to incorporate augmented reality technology to give players a more immersive experience. It should also take multiple players with different roles in order to complete the game. Aside from these requirements, the four of us were free to develop whatever we wanted.

The research phase

Before we even started the project, we have had multiple brainstorm sessions that revolved around deciding what kind of game we wanted to develop and how we could develop it in a way that not only satisfied the requirements of the project, but was also interesting to develop and feasible to create given the timeframe of ten weeks (eventually, because Rafael was not in the Netherlands on the date on which the project presentations were held, we got an extra week). During these pre-project brainstorm sessions, Rafael often showed us what was possible with AR technology right now, which really inspired us to make something awesome. During the first week of the project, we showed our final game concept suggestions to both Rafael and Stephan and all of us agreed on one thing: the mirror game was the most interesting while still remaining feasible.

But what is this game? Well, at its core, the game is similar to the game The Talos Principle: for every level, you have a laser and a target. The laser beam, coming from the laser, has to hit the target in order to proceed to the next level. Also, there is a select amount of mirrors available for you to diverge the laser beam from its original track to the target. "But how is this a project suited for getting your Bachelor's degree? And how does this work with AR?" I hear you ask. Well, our game has an interesting twist: the levels are projected on a board and are visible through AR glasses (we used the Meta One for the project, which suited our needs the best), and because there is a main camera situated above the board, the game is also visible through a computer screen (more on why that has been implemented in a second). Secondly, there are two types of players: "local" players (players that are near the board and wear AR glasses to see the projected levels) and "remote" players (players that are away from the board and can see the level on the computer screen). Both types of players can see the entire level. The one difference between the local and the remote players, however, is that local players can move the mirrors across the

level, but not rotate them, while the remote players can rotate the mirrors but not move them. This is because the mirrors are projected by the AR glasses onto mirror markers (which look like QR codes, but are less complex due to being only 6-by-6 pixels), which only the local players can move, but rotating the markers is of no use to rotate the mirrors, and that has to be done by the remote players.

Design of the system

The game was created with the Unity game engine, and because of this, it was written in C#. The game uses five main components: the Core component (which contains all the behaviour of level elements), the Network component (which handles all synchronization of mirror locations and rotations across all players), the Projection component (which takes care of projecting the world after tracking the markers), the Vision component (which is a small component which provides hardware-specific details for marker tracking) and the Level component (which takes care of building and loading the next level if the previous one is completed). Aside from that, the code, necessary for the main camera above the board to recognize the markers and show how the level looks to the remote players, is developed in C++, and makes use of the OpenCV library to implement marker tracking more easily, as well as the Qt framework for allowing cross-platform development of the server. Level markers (small red cubes with a yellow cube in the middle) are used for the main camera to let it know how large the playing field is.

The system has a basic server-client design. There is one machine that is connected to the main camera, which serves as the server for the rest of the players. The rest of the players can connect to the server by entering the IP address of the server once the game is launched and choosing to be either a local or a remote player. In order for a player to be able to play as a local player, the local player has to have the Meta One glasses connected to their machine. Remote players do not require additional hardware in order for them to participate.

Design of the levels

The levels in the game have several different objects. Aside from the obvious objects, like the laser emitter, the mirror and the target, the game also has walls (which completely block all laser beams that are aimed at them, because the game would be uninteresting otherwise), checkpoints (all checkpoints and targets in a level have to be hit by a laser beam in order to proceed), portals (which allow a laser beam to be transported to the other portal linked to the first portal), and beam splitters (which split one laser beam into two, necessary for levels with multiple targets and only a single laser emitter). Also, both the laser beams and the targets can have different colours. The colours are limited to red, green, and blue, and a target will only count as hit if a laser beam with the same colour hit it.



Challenges of developing the game


The project was extremely challenging to develop well enough such that the customer was satisfied with the product. The main challenge of developing the game was getting the game with the projection code to work with the Meta One augmented reality glasses. The Meta One was the best option for us, but that did not mean that it was anywhere near well functional. In fact, the Meta One was still an experimental piece of AR hardware at the time. Luckily, we had access to the Meta SDK, which allowed for easy integration of the Meta One glasses with Unity, including tracking. However, this did not solve every issue (otherwise, there would be no need for the Vision component of the system). One issue was that the projected level objects were way smaller than what could be considered usable, because of how the Meta One scales Unity units and how it differs from the scaling that the main camera uses. All these issues were solved by the developed components.



Another challenge was getting the state of the level to synchronize across all players, both local and remote. Unity has built-in functionality for multiplayer games, and we used that at the beginning, but it was incompatible with what we wanted to do. What's more, for the project, the C# code of the game clients had to communicate with the C++ code of the game server via a network. Because of this, we opted to develop the communication through the use of sockets, which were available for C# as a facility built into the runtime environment, and they were available for the C++ server as well, as Qt provided a Network module with TCP sockets. Communication is done through a simple protocol that both the server and the client understand. This also gave us more control over the communication between the server and the client.

Assessment of the project

In the end, we overcame all the challenges, and presented the working game to Stephan, Rafael and the Bachelor Final Project coordinator, Felienne Hermans. The extra week that we got for finishing our project was really beneficial to us, considering the challenge of developing the project. At the end of the presentation of the project, we allowed our supervisors to have a go at actually playing it. They were really enthusiastic about the game. After playing, they went out of the presentation room to discuss our grade, and came back with the news that, considering the difficulty of the project (Felienne mentioned that it was one of the hardest projects that was available that year) and the quality of what we eventually managed to deliver, we passed the project with a 9, which conventionally is the highest grade that one can get for the Bachelor Final Project. We were very proud of ourselves that we not only finished the

project, but also finished it with a good grade. Overall, while the project had some less fun parts, it was a fun experience, and I wish everyone that is doing the project right now the best at completing it! 



BLOCKCHAIN FOR ANTI-COUNTERFEIT

Written by: Alexander Groot, Technical advisor at UL Transaction Security

How blockchain technology can be an anti-counterfeit solution

Fake it 'till you make it? When looking at trade, counterfeiting seems to be a real problem since roughly 7-8% of global trade is comprised of counterfeit/pirated goods. It is spread across various sectors ranging from consumer (digital) goods to technology and pharmaceuticals [ref1]. This amounts to more than \$500 Billion of lost sales globally and it is worthwhile to battle this problem. Consumers should be assured of the authenticity of the products that they are buying. Often these products include an identifier to prove their authenticity. However, the identifier should be hard to copy and easy to verify.

CURRENT SOLUTIONS

Current anti-counterfeiting solutions can be broadly classified into two categories. The first where the authenticity can be verified without any special equipment, e.g. unique label or a hologram, and second where specialized tools/skills are needed to verify the authenticity of the product in question, e.g. watermarks or temperature-sensitive inks.

With modern manufacturing techniques it is becoming easier to outwit the above mentioned anti-counterfeit solutions. A solution to this problem can be found in the Blockchain technology, the backbone of Bitcoin.

HOW IT'LL WORK WITH BLOCKCHAIN

Let's say the manufacturer (sender) has completed the product and now wants to send it to the retailer (receiver). Along with the physical transaction, shipping of the product, the manufacturer will also perform a blockchain transaction. To perform a blockchain transaction the sender will require two things: a private key to sign a message and the receiver's digital address. The message to be signed contains information about the sender, the receiver's digital address and any other relevant data such as product characteristics.

On a high level, the sender computes a hash of the message and signs it with its private key. The signed message, the unsigned message and the sender's public key is sent to the blockchain network. The members of the blockchain network verify the hash and upon verification add the transaction to the latest block in the blockchain. Such a process prevents fraudulent transactions by providing verification of product ownership. The full history of the product, its sub-components or any transfer of ownership is recorded in the distributed ledger and can be verified by anyone with access. Any diversion from the product's intended path can be clearly observed, making it easier to track and identify stolen goods. The entire process is transparent and there is no need to base the product's authenticity only on trust.



To bridge the virtual and physical world the product could, for example, be labelled with a unique number. The exact form is dependent on the product in question. The unique number could be the public key, in part or whole, of the manufacturer's private key corresponding to the product. As the product ships from one member of the supply chain to another, the number is signed with the sending member's private key. Consequently, at any point in time it is possible to trace the entire path of the product.



As an example, let's assume that the number is displayed as a QR code. A retailer can, on receiving the product, verify the full history as it went through the entire supply-chain. Scanning the QR code will provide the retailer information to verify the signature of the product's sender, making it harder to sell counterfeit products. The design and process of the verification itself can have many forms, but technically one would just need an online portal or mobile phone to enter or scan the unique number and verify the path (authenticity) of the product. This verification system can be fully open to everyone, restricted or a hybrid (combination of both).

The concept described above is already being developed by several start-ups. There are applications in the space of diamond trading (to verify their origins), pharmaceuticals, electronics and other luxury items.

CHALLENGES

The solution proposed above is not free from challenges. From a technical aspect, the private keys generated should be unique and have

minimal probability of a collision. Furthermore, it is imperative to use a hash function which is cryptographically secure [ref2]. Another challenge is how open the ledger should be, public, private or hybrid. Ideally one would like the hybrid system with a public part accessible for the consumer and a private part accessible for the manufacturers and suppliers.

From a business aspect the challenge lies in the implementation of the solution. As a manufacturer, bulk buyer or any other member in the supply chain, one would have to participate in this process and should be willing to make the effort of implementing such a solution. In addition, the consumer uptake might prove to be a critical factor in the success of a blockchain based anti-counterfeit solution

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Advertorial



Anonymous HD Video Streaming for Android using Tribler

Nick Feddes

At the end of the Computer Science Bachelor, students have to show their competence and are assigned a project from the real world. This can be a project for any client whose submission gets passed by the bachelor coordinators (am I giving anyone ideas here?). Here you can read about the project of me and my fellow two students; C. van Bruggen and M. Vermeer.

Project domain and goal

Our project had a very long name (Anonymous HD Video Streaming for Android using Tribler), yet did not manage to accurately describe all of our activities during the project. Let me start by explaining Tribler. Tribler is an application developed at the TU Delft and has been installed by over one million users. It acts like - and is compatible with - a BitTorrent client, which means it can be used for peer-to-peer file sharing. But it doesn't end there. It also comes with strong anonymity because of its Tor-like onion routing protocol. If that isn't clear to you then just remember that Tribler can be used to anonymously transfer files and because of its peer-to-peer functionality, file sharing becomes faster as more users are downloading (and thus 'seeding' / uploading) the file.

That's where anonymous HD video streaming comes in. Video streaming just means that the video is being played while it gets downloaded. Services like Popcorn Time (an alternative to the better known service called Netflix) have used video streaming via BitTorrent clients to let users consume their video content, since it is cost effective and fast when many users are watching at once.

Let me introduce you to the client of our project: Dr. Ir. Johan Pouwelse. He was already passionate about peer-to-peer before Napster's music sharing application popularized it in 1999. While Pouwelse would of course love for there to be a viral video streaming service such as Popcorn Time that uses Tribler, he had a more noble vision for Tribler's usage in our project: to help journalists and citizens of countries with strict regimes get out important information anonymously. Imagine, for instance someone, witnessing an event or act that could put a government in a bad light. The observer might have used his smartphone to capture the scene. Since video is often seen as a stronger form of evidence than word of mouth (if it wasn't recorded with a potato), there is quite some value to this video material. Now the question becomes how this person can quickly get this information out without leaving any traces to himself (since in some countries this might land him in prison or even cost him his life), and also how others from the same country can view his

content without being tracked. Because of the use case described above it was determined that the final product had to be a smartphone application, which was narrowed down further to an Android application.

Libraries, libraries everywhere

After an initial research phase in which we considered alternatives to Tribler, got up to date with previous projects done by students in order to achieve the main goal of 'Anonymous HD Video Streaming for Android using Tribler' and investigated the methods and tools that we had to use for our task, we got going. The main technical aspects of our project included getting Tribler to run on Android. Tribler is written in the Python programming language. This means it is not out of the box compatible with the Android framework. We used a tool called 'Python for Android' to generate an Android .apk file, which could then be used to install the app on the users smartphone. But Tribler contained many libraries, and some of these libraries had their own libraries which at times had even more libraries (so our project itself was like watching an HD version of 'Inception'). Some of the libraries weren't even written in Python, but were made in C or C++. Others were just not meant to run outside of a desktop environment at all. This is the part of the project that used up most of our time. We had to write so called 'recipes' (Linux batch files) which allowed us to cross-compile the libraries to work on Android.

These recipes would set the right configurations for successful cross compilation, patch up some libraries to make them compatible with Android, and at times we had to come up with our own creative solutions to get it all working. Sometimes we, for instance, modified Tribler itself so that it would better aid us in our progress. This is of course one of the benefits of using an open source application developed at your own university. We could also ask the Tribler development team for help at any moment since their offices were as good as next door.

On the one hand, this part of the project where we had to cross compile Tribler's libraries felt like doing awesome work in uncharted territory. Some of the libraries that we managed to 'port' over to Android had probably never been ported before. On the other hand, it's different from what I would call a 'normal' software project, where you contribute feature after feature to your software. In our case we had to deal with big uncertainty, because sometimes after trying for a full week to port a library you would not know if you'd ever be successful. It could mean that you had to try a radical new approach (for instance finding and integrating a replacement library that could in fact be ported). In the end we did manage to port over all of Tribler's libraries except one. This one library was a tough one and combined with the fact that it was scheduled to be updated by its developers in a couple of months (the specific update would make porting the library way easier), we decided to leave it out so we could focus on the other aspects of the project. Leaving this library out meant that everything worked, except some of the anonymity functionality.



Digging up old projects

I briefly mentioned previous projects done by students to reach the final goal of our project. One of these groups developed a native Android application (in the Java programming language) that acted as a user interface from which several features from Tribler could be accessed. This application was called TSAP (Tribler Streaming Android Project). The Java part of the application used a technique called XML-RPC to communicate with the ported Tribler and its libraries. We used this application and updated it to make it work with our ported version of Tribler. By patching up this application we could test out whether the various features of Tribler were working on Android and we had something visually appealing for our demo during the final presentation (because it's hard to give a demo of some recipe scripts that successfully cross-compile Tribler and its libraries).




Using TSAP to download a video (on the left) and to play a video being streamed (on the right).

The Shadow Internet

During the project we had the privilege to share our office with the two students from the Shadow Internet group. They developed an Android application that could capture video footage which could then be passed on to other smartphones using NFC (Near Field Communication) or Bluetooth. Even the app itself could be transferred over via NFC. This allows the user base of the app to grow and share video content without anyone noticing, hence the name 'Shadow Internet'. In order to let users stream videos with the app anonymously, we had to integrate our ported version of Tribler with the app. Unlike the TSAP application described earlier which was written in Java, this application was written in Python and ported with the same tool we used to port Tribler. The integration was therefore different and yet again we had to dive into a new project, make our changes and get out. On that note I think it's time for a conclusion.

Final words by our sponsor

It was a great project to work on and very educating. I liked the fact that it was something other than the normal 'software-oriented' projects I have worked on. This takes you out of your comfort zone and forces you to learn something new. At the start of the project I had to dual boot my laptop so I could run Linux as well (VirtualBox didn't do), since the main tools we used only worked on Linux. We had to deal with many different code bases such as Tribler, TSAP, the Shadow Internet app and Python for Android (to the last one we submitted some updates which were officially accepted).

On top of that we met with a guy from Iran who could be seen as a potential user of our end product. He told us how the Iranian government was involved in heavy censorship and what methods they are using now and have used in the past to achieve this. 

If you're interested in knowing more about our project you could always read our full report at <http://repository.tudelft.nl/view/ir/uuid:5bd6da9f-1464-4203-a383-321ab34d4386/>.



Binary Puzzle

Normal sudoku's are boring, so that's why we added a binary puzzle this time! The rules are a little bit different in comparison with a Sudoku.

here are four rules that you need to follow to solve it correctly:

- Each box needs to contain either a 0 or a 1
- No more than two similar numbers are allowed next to or below each other
- Each row and column should contain an equal number of zeros and ones
- Each row is unique and each column is unique

Good luck solving it!

	0		1						0				1
0						0							
	0			0		0				0			1
0			1				0						
		1		1				0		1		1	
0					0			1	0				
		1				0						1	
	1			0					0				0
0	0			0							0		1
1	1				1				0			1	
			1				1		1	1			
	0	0			1				1				
					1						0	1	
0				0						1		1	



HootHub

Beer van der Drift

Gamification is a concept which has proven itself over and over again; from public websites as Reddit all the way to our own Alexandru Iosup. In the last few years our study association has seen small IT projects, which have been mainly developed behind the scenes. As an association that is partly related to the Computer Science studies, we of course have a lot of brainpower and enthusiastic people who have the ability to make great stuff. So why do we develop our own software behind the scenes and not publicly with the help of anyone willing to develop? Recently, HootHub was introduced, a “game” wherein anyone is able to participate in the systems that enable Christiaan Huygens to do what it does!

HootHub started as an initial idea which was born while drinking some beers in the /Pub. After discussions on the idea with more and more people, there seemed to be potential in the idea. After much refinement and discussions, we were able to pitch the idea in front of the association at the General Assembly. We got the green light and are proud to present to you our little baby: HootHub!

So how will this system take shape? As an Owl, you will start off at level zero with a beautiful egg as badge. You will be able to participate in a project through GitHub, where the lead developers have split the project in very small problems, commonly known as tickets or issues. Every ticket will be assigned an amount of “Uilenballen” (Owl Balls) that can be earned upon implementing the ticket.

Once you have earned enough Uilenballen, you’ll level up! Not only will this bring you great pride but there are actual rewards to earn as well! The first few levels will bring smaller rewards such as a special HootHub ballpen, but our aim is to be able to provide cool rewards for higher levels.

Next to the rewards there will also be a slide on the CH TV with the top performing Owls of the month, year and all time. We are planning on making a wall where any Owl can put something up as a remembrance, which will be a reward. Also, we might introduce a special page in our yearbook which will list the top Owls.

We hope that this project will take off once we start the pilot. Our vision for the system described above still needs to be proven, so we have developed a very slimmed down system with manual tracking that we will use for now. The first projects that will be picked up are internal and external systems, meaning these will be both the systems that are only used behind the scenes as well as systems which are used by all members. Some already exist– and we just like to make development open– but there are also some green-field projects.

The projects that we will pick up in the pilot are ‘Dienst’, ‘Choice’ and ‘Events’. Dienst is a system which is used for the administration of the members, registry and mail. This is a system which most members are not familiar with, so this is a perfect opportunity to take a peek under the hood of the association!

The second system is ‘Events’. This system will be used to enable members to register for lunch lectures and other events. Currently, this is usually done using a Google form. However, having an in-house system has multiple advantages.

The last system that we will pick up is ‘Choice’. This is the association’s system which lists all old exams of many of the courses in the Computer Science and Mathematics Bachelors and Masters. While this system is up and running, there are still some ideas to be used as improvement.

By setting up HootHub we do not only hope to have higher development cycles of our systems, but we also want to invite people to be able to see what our association runs on. We believe in open source development, and so this is the path we would like to take with HootHub.

If you would like to be one of our awesome developer Owls and start levelling up, you are more than welcome to visit our page and join a project! For all projects and extensive guides, please visit <http://wisv.ch/hootHub>. Any questions can be directed towards hootHub@ch.tudelft.nl. Hopefully we will see you as a member of HootHub soon! 



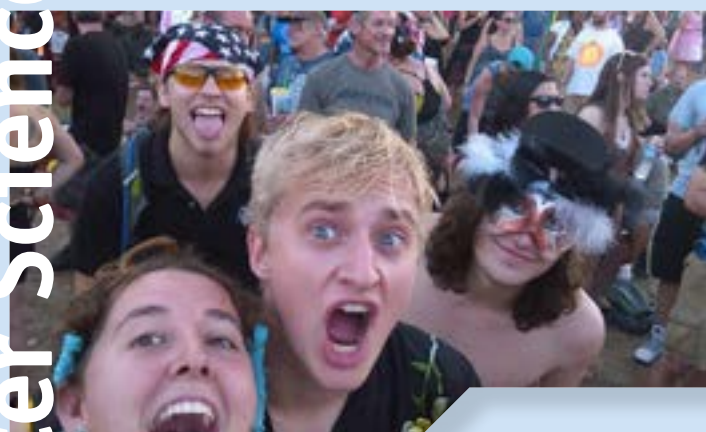
Minor Abroad: USA

Wouter Posdijk

It is such a diverse world we live in. So much to explore. So much to experience. That is why I wanted to go on an exchange. But I did not want to go to Louisiana. It was definitely far, far away from my top five.

Through my inability to get anything done on time, it became one of the few options left. My desire to go somewhere and the fact that ‘it’s warm there’ made me choose to go to Louisiana State University after all. And that is one of the best things that has happened to me in all my life.

As humans, our minds are constantly aimed towards judgement. We see any kind of object, situation or concept and we instantly judge it. Very often this first impression turns out to be very accurate; humans are very good at sub-consciously acquiring knowledge, ‘feeling-wise’ and applying that knowledge in an instant. However, when considering judgements of concepts that we have never been in touch with, this ability falls horribly short.




Before embarking on my journey, I had never set foot outside of Europe, yet I had huge opinions about many places outside it. To state a few, with respect to the United States: all people there are fat and stupid, the food is bad, people waste gas all the time, the war on drugs has gone way too far, and so on. Mostly negative biases, or truths, as it may turn out. I think that this is the general view young Europeans have of the States, and that is what managed to get me excited to actually go there; I could finally find out whether or not all my biases were justified.

After exploring the intense emotions that came to be after I left for the States, and watching a bunch of movies on the handy screen in the plane, I arrived in Houston. A humongous American flag was hanging from the ceiling at customs. Bias 1: “Americans sure love their flags” turns out to be true, or at least so I concluded from my particularly anecdotal evidence.

Just having arrived in this country for the first time, there were a lot of impulses, and it was hard to keep track of them. Quickly, Bias 2: “American customs take hours and they check you to the point of physically and mentally harassing you” was debunked in a very pleasant fashion; I showed my documents and walked on through. I even got a polite ‘How are you doing?’ from the coastguard officer. I would later learn that this is but a southern formality, albeit a pleasant one.

I took an Uber to the Greyhound station (Greyhound is an intercity bus service), and got in line for my bus to Baton Rouge, Louisiana, when a guy a couple feet shorter than me walked up to me and asked: “Hey man, please don’t be scared, but I just got out of prison, and you know, is dubstep still a thing?”. I told him that he could find a party in Europe if he wanted to, and I exchanged some of my music for his rap music. Turns out my entire line was filled with ex-convicts talking about how “their cousin was in for life” and other things of the like. It seems that Bias 3: “Too many people are imprisoned in the US” is a very sad truth.

After arriving on the college campus, I got sheltered from this sadness and was allowed to live my life in my own perfect bubble. And perfect it was. Everyone I have met has been amazing. I have binged on Ben & Jerry’s with my roommate while watching movies (if that ain’t the true dorm life, I don’t know what is), I have enjoyed true southern barbecue, and I have danced to jazz and funk more than I could ever imagine. These things were all made possible by the insane amount of hospitality that people feel in the south. I put myself out there, ready to have fun, and people had no problem taking me along to all the fun things that their state had to offer. That brings me to Bias 4: “Everybody in the south is a bigoted redneck”, which really is just a bias.

I did not mean to go to Louisiana. I never wanted to go to Louisiana until it was my only choice left. And I still would not put it in my top five, because now I know that you should not pick what you already know. Next time, I am going to pick the place that I know the least about, such that I may learn as much about this world as possible. The world is too beautiful not to do that. 



Radiotherapy
Studying Abroad
PreUniversityCalculus
SynapticReceptor
India
DecisionMaking
Graduation
Algorithm
Minor
Mathematics
WorkingMaster
Alumnus
MOOC
Experience
MulticriteriaOptimisation
DendriticSpineMorphology
HumanBrain





Multi-criteria optimisation and decision-making in radiotherapy

Sebastiaan Breedveld & Rens van Haveren

When treating patients with radiotherapy, healthy organs may be damaged, resulting in loss of functionality. The distribution of the dose over the different organs is modelled as a multi-criteria optimisation problem. As there is not a single optimal (or “golden”) solution, decision-making is used to find a clinically acceptable solution.

Radiotherapy (radiation therapy) is used in treating $\approx 50\%$ of cancer patients. Due to irradiation of healthy organs surrounding the tumour, severe side-effects may be induced, impacting the patient’s quality-of-life. For example, reduced functionality of salivary glands may result in dry-mouth syndrome. This urges the patient to drink some water every half-an-hour (day and night). Damaged swallowing muscles impairs the consumption of solid food, and limits the patient to eating mashed food, or using a probe.

It goes without saying that each complication has a significant impact on the quality-of-life of the patient and it is thus of utmost importance to reduce the probability of developing treatment-induced complications. The dose levels for which complications occur are not fixed, but differ between patients.

Also, different organs have different radiosensitivity and it is therefore important to consider the dose to each organ separately. The dose to the different organs is correlated, resulting that sparing one completely may result in the inability to spare the others (see figure 1). This means that a trade-off has to be made between the doses to the different organs. A typical trade-off could be between the dose to the salivary glands and the dose to the swallowing muscles, where a balance has to be found between dry-mouth problems and swallowing problems. A real multi-criteria problem in radiotherapy typically consists of 20-30 criteria.

We use techniques from *multi-criteria optimisation* and *decision-making* (MCDM), subfields of Operational Research, to find clinically acceptable treatment plans, and to automate the decision-making process.

Multi-criteria optimisation

A multi-criteria optimisation problem is formulated as follows:

$$\begin{array}{ll} \text{minimise} & [f_1(x), f_2(x), \dots, f_n(x)] \\ \text{subject to} & g(x) \leq 0 \end{array}$$

where $f_i(x)$ are nonlinear real-valued functions, $g(x)$ is a set of nonlinear constraints and $x \in \mathbb{R}^m$ the decision variables. The goal of multi-criteria optimisation is to find a balance between the criteria $[f_1, f_2, \dots, f_n]$. An important concept is *Pareto-optimality*. A solution $[f_1^*, f_2^*, \dots, f_n^*]$ is Pareto-optimal if an improvement for one criterion results in a deterioration for at least one of the others, i.e. there is no gain without loss. This concept is visualised in figure 1 for $n = 2$.

However, there is not a “golden” solution. What is an acceptable trade-off is determined by the long-term experience and insights of the physician (medical doctor). It is clear that there is not a sane trade-off near the extremities, as there is a huge gain for one with only a slight deterioration of the other. But what makes a clinically acceptable trade-off is less well defined. There are different approaches to handle this *decision-making* problem. One is to give full control to the physician, and let him/her determine the most favourable solution. Another approach is to formalise the decision-making process, allowing automated decision-making. The challenge of automated decision-making is to find a general configuration which results in clinically acceptable plans for different patients (within the same treatment group).

Pareto front navigation

By using Pareto front navigation, the physician (operator) can freely explore the trade-offs between different criteria (see [3] for an interactive example). This way, the different doses belonging to the different solutions are directly visualised. For a bicriteria problem, the Pareto front can be spanned by solving:

$$\begin{array}{ll} \text{minimise} & \alpha f_1(x) + (1 - \alpha) f_2(x) \\ \text{subject to} & g(x) \leq 0 \end{array}$$

for weights $\alpha \in [0, 1]$. Each value of α gives a unique Pareto-optimal solution.

There are some practical problems, resulting from the *curse of dimensionality*. A uniform distribution of α does not necessarily result in a uniform distribution of points on the Pareto front, and doing this for $n > 3$ is not straightforward. Decision-making is also problematic: humans are in general capable of considering up to 5 criteria simultaneously, so it is questionable if the operator will always reach an optimal decision, or will reach the same solution a second time (reproducibility).

Sequential ϵ -constraint programming

Radiotherapy treatment plan optimisation requires consistent, reproducible and fast decision-making (for several reasons). The idea is to automate decision-making by mimicking the human decision-maker’s decision pattern. This is possible by constructing a prioritised list with goal values to reach for each criterion. An example is given in table 1.

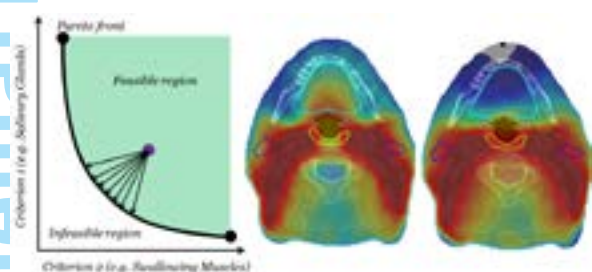


Figure 1: Left: Pareto front. A non-Pareto optimal solution (purple) can be improved in one or more criteria, until it is on the Pareto front. The black dots at the end of the curve are the extremities, i.e. full minimisation of one criterion. Middle and right: Pareto optimal treatment plans with different trade-offs. Cyan = mouth, yellow = a swallowing muscle, blue/green = salivary glands. Colourwash: More red (hotter) = higher dose (damage).



Table 1: Constraints and criteria

Constraints			
	Name	Type	Limit
	Tumour	minimum	43.7 Gy
	Nerves	maximum	45 Gy
Criteria			
Priority	Volume	Type	Goal
1	Salivary Glands	minimise	40 Gy
2	Swallowing Muscles	minimise	50 Gy
3	Salivary Glands	minimise	20 Gy
4	Swallowing Muscles	minimise	40 Gy
5	Salivary Glands	minimise	0 Gy
6	Swallowing Muscles	minimise	0 Gy

In this list, there are 2 hard constraints and 6 prioritised steps which are processed in sequential order. The idea is that in each step, the criterion is minimised up to, but not lower than the given *Goal*. This is to prevent that the solution is steered to one of the extremities, severely limiting the sparing of other criteria. This criterion is then added as a constraint to the problem. Formally, the steps taken are:

$$\begin{array}{ll} \text{minimise} & f_1(x) \\ \text{subject to} & g(x) \leq 0 \end{array}$$

Depending on the result $f_i(x^*)$, the new bound is chosen according to the following rule:

$$\epsilon_i = \begin{cases} b_i & f_i(x^*)\delta < b_i \\ f_i(x^*)\delta & f_i(x^*)\delta \geq b_i \end{cases}$$

where b_i is the Goal for f_i (table 1) and δ is a slight relaxation to create some space for the subsequent optimisations, usually set to 1.03 (3%). This step leads to more favourable trade-offs by steering the solution away from steep parts of the Pareto front.

The next optimisation optimises f_2 , keeping f_1 constrained:

$$\begin{array}{ll} \text{minimise} & f_2(x) \\ \text{subject to} & g(x) \leq 0 \\ & f_1(x) \leq \epsilon_1 \end{array}$$

and so on.

The list in table 1 describes a balanced search between the 2 criteria, similar to a manual search. The advantage is that many criteria can be included, and that the search is deterministic. The challenge is to find a uniform configuration (list) which results in clinically acceptable plans for each patient.

Lexicographic Reference Point Method

A disadvantage of the previous method is that it requires many optimisations. Essentially, this method follows a path through the criterion-space (while obeying the imposed hard constraints, e.g. as in table 1). The idea of the Lexicographic Reference Point Method (LRPM) is to optimise along this path, resulting in a single optimisation problem. This implies shorter calculation times, in particular when the list contains many criteria and priorities. The idea of the LRPM is to express the preference structure through *reference points*. A reference point is a vector in which each coordinate represents a goal value for one of the criteria. These goal values are equally important to attain, e.g. the reference point $(f_1, f_2) = (20, 40)$ indicates that attaining 20 for f_1 is as important as attaining 40 for f_2 . However, different reference points have different priorities: the first priority is to attain the worst reference point. If

feasible, the focus is on attaining the second-worst reference point. This process continues until no improvements are possible. Intuitively, the worst-case scenario (first reference point) is steered in a prioritised manner towards the ideal scenario (last reference point). The flexibility of using multiple reference points allows us to prioritise the criteria, e.g. see figure 2: in between every pair of subsequent reference points, the focus alternates on decreasing either f_1 or f_2 . This approach can be extended for an the general case (n criteria) in which one can specify a finite number of reference points that strictly decrease coordinatewise.

The next step is to design a *reference path*: a parametric curve through the criterion space that connects the reference points so that the parametric equations are strictly decreasing. Then, a single optimisation problem is formed [2] to process all objectives and their priorities. Intuitively, the reference path is followed until it intersects with the Pareto front. This intersection is then the returned Pareto-optimal solution.

To apply the LRPM with a uniform configuration for a group of patients, some modifications are needed. The intersection of the reference path and the Pareto front may occur on a steep part of the Pareto front (representing an undesired trade-off) for some patients, see figure 2. To overcome this issue, we need a mechanism that excludes the selection of solutions near the extremities. Hereto, *trade-off curves* are modelled into the LRPM: without the trade-off curves, the red plans are generated while the clinically favourable plans (green plans) are generated with the trade-off curves. In conclusion, even though the clinically favourable plans seem scattered and unstructured, there is an underlying preference structure that can be captured by the LRPM using a uniform configuration (reference points and trade-off curves). This allows us to apply the LRPM with fixed parameters per treatment site.

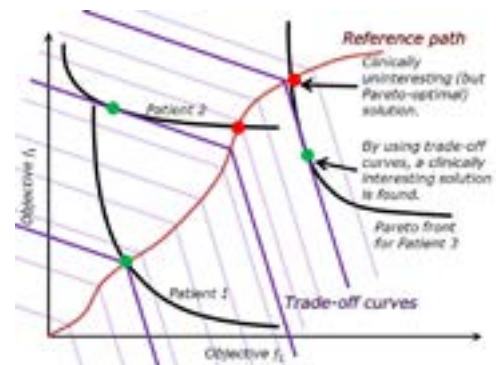



Figure 2: The effect of adding trade-off curves. The black lines are the Pareto fronts for three different patients and the green/red dots represent the generated plans with/without trade-off curves.

Automated Radiotherapy Treatment Planning

The ability to automate decision-making allows to cope with other complex parts of the problem, resulting in fully automated generation of radiotherapy treatment plans. The quality of these plans are in general equal, and often much better than existing clinical practise. Currently, these methods are in clinical use in the Erasmus University Medical Center in Rotterdam. 

References

- [1] Breedveld S., Storch P. & Heijmen B. (2009) *The equivalence of multi-criteria methods for radiotherapy plan optimization* DOI:10.1088/0031-9155/54/23/011
- [2] Van Haveren R., Breedveld S., Keijzer M., Voet P., Heijmen B. & Ogryczak W. *A Novel Lexicographic Reference Point Method with Bounded Trade-offs Applied in Radiation Therapy Treatment Planning* (to appear)
- [3] Pareto front navigation example: http://sebastianbreedveld.nl/rt_paretonavigation.html



The effect of dendritic spine morphology on synaptic receptor trafficking

Tamara Kloek

"If the human brain were so simple we could understand it, we would be so simple that we couldn't."

– Emerson M. Pugh.

Every beginning has an end and every end is succeeded by new beginnings. The end of my student life began with working on my master project, which ended by defending my master thesis on December 17th 2015. I worked on this project with Fred Vermolen and Remy Kusters (TU Eindhoven). Here, I will subsequently answer the "why?", the "how?" and the "so?" of this research.

Why?

Signals are transmitted within an animal body through the nervous system. The control of muscles, processing sensory stimuli and regulating cognitive processes are all carried out by the nervous system. At the cellular level, the nervous system consists of a special types of cells, called neurons. Neurons can transmit signals to other neurons through specialized junctions, called synapses. For healthy functioning of the nervous system it is important that the strength of these connections (synaptic strength) can be specifically controlled. Failure of these mechanisms are associated with neurological and neuropsychiatric disorders like schizophrenia, Alzheimer disease, depression and autism [1, 2].

In chemical synapses the transmitting neuron releases a chemical substance into the synapse, which can bind to a surface receptor present on the cell membrane of the receiving cell, as shown in Fig. 1. An important factor in the synaptic strength is the amount of receptors present on the synaptic cell membrane of the receiving cell. Therefore, controlling the number of receptors at synapses is essential in synaptic transmission [3], thus it is interesting to investigate the mechanisms that influence this number.

One of these mechanisms controlling the number of receptors at synapses is *surface diffusion*. Generally, receptors are not bound to the cell membrane, but can diffuse freely over this membrane. An important factor influencing this diffusion process is the morphology of the spine (the receiving part of the synapse, see Fig. 1). Spines come in different nontrivial shapes, as shown in Fig. 2 and the necessity of having this shape is not well understood. This leads to the following question.

Could it be that the morphology of dendritic spines allows the synapse to function more effectively? In other words, could it enable the synapse to regulate the amount of receptors?

In order to answer this question, we used two different models of diffusion. The one we discuss here is an atomistic, particle-based approach in which diffusion is seen as distinct particles undergoing Brownian motion.

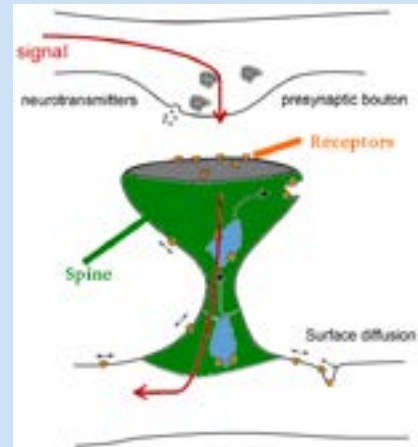


Figure 1: Signal transmission in a synapse.



Figure 2: Spine morphology.

How?

Before we can answer our question, we have to define the morphology of the dendritic spines and how we compare different morphologies. We used the work of [4] to do this. The resulting shapes can be found in Fig. 3a. For fair comparison we scaled these shapes such that the green surfaces of Fig. 3b all have the same surface area.

We use a global parametrization $S(\alpha, \beta)$ for the surface,

$$S(\alpha, \beta) := \begin{pmatrix} x(\alpha, \beta) \\ y(\alpha, \beta) \\ z(\alpha, \beta) \end{pmatrix}, \quad (1)$$

with the associated metric

$$g_{\alpha\beta} := \begin{pmatrix} S_\alpha \cdot S_\alpha & S_\alpha \cdot S_\beta \\ S_\beta \cdot S_\alpha & S_\beta \cdot S_\beta \end{pmatrix}, \quad (2)$$

where S_i are partial derivatives of $S(\alpha, \beta)$. From this we can calculate the Christoffel symbols Γ_{ij}^k as

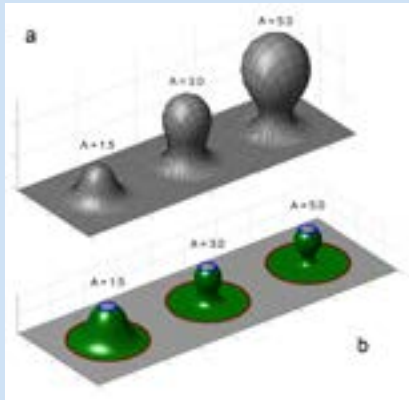


Figure 3: Shapes of spines used in this research.

$$\Gamma_{ij}^k = \sum_{m=\alpha,\beta} \frac{1}{2} g^{km} \left(\frac{\partial g_{mi}}{\partial j} + \frac{\partial g_{mj}}{\partial i} - \frac{\partial g_{ij}}{\partial m} \right), \quad i, j, k = \alpha, \beta, \quad (3)$$

where g_{ij} are entries of the metric $g_{\alpha\beta}$ and g^{ij} entries of the matrix inverse to the metric $g_{\alpha\beta}$ from Eq. 2.

Now we have these formalizations in place we can proceed to the algorithm used to update the location of each distinct particle in each time step, given in Alg. 1.

Algorithm 1 Algorithm used for updating position of particles.

Initialization

Fix a spacial step size $\lambda > 0$.

Set $\Delta t = \lambda^2 / 4D$, where D is the diffusion coefficient.

1: Choose a test step $\Delta \mathbf{r}$

- Choose a unit vector \mathbf{w} from a uniform distribution over all directions.
- Calculate $\Delta \mathbf{r}$ by moving a length λ along a geodesic in direction of \mathbf{w} .

2: Update $(\mathbf{r}, t) \rightarrow (\mathbf{r} + \Delta \mathbf{r}, t + \Delta t)$.

A geodesic curve parametrized by arch length s can be approximated with a Taylor expansion,

$$\mathbf{r}(s + ds) = \mathbf{r}(s) + \frac{d\mathbf{r}(s)}{ds} ds + \frac{1}{2} \frac{d^2\mathbf{r}(s)}{ds^2} ds^2 + \mathcal{O}(ds^3), \quad (4)$$

The first order derivative is simply the unit tangent vector \mathbf{w} and the second order derivative can be calculated from the Christoffel symbols.

With Algorithm 1 we can initially position any number of particles on any location on the defined surface and update their positions for each time step after initialization. With these tools we are almost ready to answer our question, we just need a testcase to apply our algorithm to.

Here, we discuss a testcase in which we have a surface with two equally shaped spines and we release particles in one of the two spines. We do two experiments and per experiment these spines have a different shape, as shown in Fig. 4.

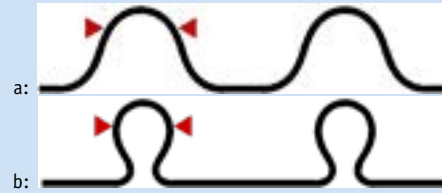


Figure 4: Two test cases.

We release particles at the height of the red arrows and then we record the concentration of particles at the top of both spines. This release of particles we call *exocytosis*.

So?

Now we have defined two test cases, we can move on to answering our research question. The results of the two test cases can be found in Fig. 5.

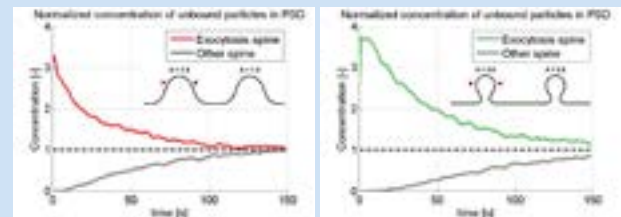


Figure 5: Results of two test cases.

From Fig. 5 we can conclude that for spines with a thinner “neck” the time needed to reach an equilibrium concentration is longer than for spines that do not possess such a neck. We can also see that the concentration stays higher for a longer period of time in the spine in which the particles were exocytosed. Therefore we can conclude that the morphology of spines allows synapses to function more effectively, by keeping the concentration of particles higher for a longer period of time. So, the particular shapes of spines are not just there for fun, we have made a strong case that these nontrivial shapes are actually helping our body to function more effectively!

Liked what you read? An electronic version of my thesis is available at <http://repository.tudelft.nl>. Furthermore, some nice movies can be found on <https://github.com/tamarakloek/spinemorphology>. Check it out!

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AIESEC internship in India

Jorien Knipping

My name is Jorien, in december I finished my bachelor Applied Mathematics. After my bachelor I was not sure what to do next. Enhance my working experience or travel. But why not both, so I decided to contact Aiesec.

Aiesec offers voluntary work and internships abroad. They mainly offer non technical internships, the only technical internships they offer are IT internships. So I went for a marketing internship at an IT company.

I work at a company called Helios Solutions, it is a company which provides IT services to European countries. My job is to manage ongoing projects. For example, when someone sends us requirements for a job we make an estimate for the amount of hours it will take and sent a proposal. We make sure that the client pays, the developers deliver the product in time and we ensure that European quality is delivered. But I also do acquisition for the company. That means that I call a lot of different companies and try to convince them to hire Helios Solutions. I like the managing part of my job the most, this because it is really challenging, due to the challenge you learn a lot. I enhance not only my managing skills but my IT skills as well.

Working in India is very different than working in the Netherlands. The work hours for instance are from 11 in the morning till 8 'o clock in the evening, so you are inside in the air-conditioning during the hottest period of the day. My boss is also very relaxed and friendly, he even throws party's and barbeque's for us. Also, we ride our scooters to work every day. The traffic here is not comparable in any way to the Netherlands, it is crazy! Everybody is honking all the time and you have to be careful not to get hit by a Riksja.

Helios is very international oriented. In that way it has interns from the Netherlands, Germany, Belgium, France and Norway. We are with 6 in total now and even live in the same house together. We work, live, party and travel together, so we immediately became a very close group. The local population in Baroda, where I live, is very kind. We already have a lot of friends who grew up here. The difference in income is very big. Some families are really poor, while others are extremely rich and live in huge farmhouses.

There is also a lot of time for fun stuff. In one of my first weekends we went to Jaisalmer, a city which is surrounded by dessert. We made a camel trip there and slept in the dessert. The next weekend we went to Mumbai and partied at the 37th floor! In addition to travelling we also meet up with locals to hangout or party. Although alcohol consumption is prohibited in this state they all seem to have loads of alcohol!

The Indian culture is very different from the Dutch culture. For example a wedding here always takes 5 days and they invite 1000+ people. After the wedding the women move out of their elderly house to live with the family of their spouse. There was a kite festival in our city, so we went to the rooftop of some locals and everywhere we could see there were kites in the air. Instead of just kiting like we do in the Netherlands, the main goal here is to cut other kites. And all the Indians are extremely fanatic, so we heard all of them exclaiming and cheering. There was a photographer that day, who made pictures of the kite festival. Apparently he also took one of us, so now we are in the local newspaper!



Figure 1: With my scooter



Figure 2: The local newspaper with pictures from the kite festival

I can recommend doing an internship abroad to everyone! I do not only learn a lot here, I also travel often and meet many people. 🇮🇳



Sono Science
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Euler
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Trends
WordSearch





Puzzle: Word Search

Ghiline van Furth

Sir Andrew Wiles recently received the Abel price, the 'Nobel price' for mathematicians, for his proof of the last equation of Fermat. This equations says that $x^n + y^n = z^n$ has no integer solutions for n bigger or equal than 3.

This may sound like a very simple equation, but the proof on the other hand is extremely difficult. For years and years mathematicians tried to solve it, but everybody failed until Wiles came with his 100 page proof in 1995.

But he only recently received the Abel price for this. This price is known for being handed out decennia after the research had been done. This also makes Wiles, with his 62 years, the youngest Abel price winner ever. The Abel committee says Wiles' proof is magnificent and they are handing out the price because his work opens a new era in number theory.

Doing the proof yourself might be a bit too difficult, that is why we added another puzzle instead. It is a word search where all the words you need to find are somewhere in this text. There are 20 words in total, see if you can find them all. Good luck! 🍀

T	A	M	R	E	F	P	L	Z	Y	Y	N	O	I	T	U	L	O	S	S
W	A	B	J	B	P	D	E	F	B	W	U	E	I	J	S	N	U	Q	P
V	Q	H	C	G	R	Z	O	L	E	F	D	G	H	D	B	T	R	F	X
B	H	R	R	E	I	I	V	Q	R	X	A	S	H	O	G	G	D	I	O
T	N	V	E	C	I	G	B	K	O	L	W	F	G	Q	Z	H	Y	M	S
J	X	M	S	I	X	F	J	K	I	P	P	F	W	I	L	E	B	A	S
Q	D	A	E	R	V	N	Y	R	O	E	H	T	R	E	B	M	U	N	T
H	R	T	A	P	X	I	S	Y	E	Y	Y	X	N	O	B	E	L	F	N
B	R	H	R	E	Y	W	B	S	U	E	Z	E	F	L	K	E	P	O	E
S	P	E	C	A	E	S	I	R	W	S	E	Q	F	W	O	R	K	A	C
K	L	M	H	L	Q	K	P	L	Z	A	T	T	R	W	O	J	B	A	I
P	N	A	T	X	V	B	J	D	E	O	Q	M	T	A	X	V	S	W	F
V	I	T	B	T	X	T	Z	L	I	S	N	D	X	I	S	U	S	J	I
I	G	I	W	E	R	D	N	A	V	F	B	K	V	Z	M	R	J	E	N
N	I	C	A	I	N	N	E	C	E	D	F	P	V	B	T	M	R	F	G
T	Y	I	P	A	Z	T	M	A	H	C	W	I	W	K	O	I	O	F	A
E	Q	A	K	J	A	K	I	J	U	M	H	T	C	O	P	S	D	C	M
G	D	N	W	J	S	D	P	R	O	O	F	M	E	U	O	R	X	A	Y
E	M	S	R	K	A	T	S	A	L	N	Z	B	U	V	L	I	O	W	D
R	P	Q	N	O	I	T	A	U	Q	E	Y	G	U	Y	J	T	V	P	T



Science Trends

Rebecca Glans

On this page you will find some brief info on recent scientific breakthroughs or interesting news. Whether they're big or small, if we think they might interest you, we will mention them here! Do you miss a certain trend or want to inform your fellow readers of an interesting innovation? Feel free to contact us.

"One of the great joys in mathematics is the ability to use it to describe phenomena seen in the physical world"

Mathematician Gino Biondini and postdoctoral researcher Dionyssios, both from the University of Buffalo, have published a new paper which answer one of the questions regarding the mathematical description of waves. "Ever since Isaac Newton used math to describe gravity, applied mathematicians have been inventing new mathematics or using existing forms to describe natural phenomena," says Biondini. Their research advances all the work that's come before. The waves discussed are not only water waves, what might have to come to the mind first, but also light and sound waves.

Representing waves using math goes all the way back to the 1700s. Half through that century Jean le Rond d'Alembert discovered the so-called wave equation describing the propagation of waves. This model has limitations as it breaks down when waves are very large and therefore nonlinear. Biondini continues "(...) when a water wave whitecaps and overturns, the wave equation is not a good description of the physics anymore."

Since the 1700s, the development of new and better ways to describe waves has continued. One of these models is the Schrödinger equation. Still, many questions remained unanswered; what happens when a wave has small imperfections at its origin? The latter is called "modulational instability" which basically means that having small perturbations at the input, results big changes at the output. It was already known that in many cases these minor imperfections would grow and eventually distorts the original wave, but there was no mathematical way to describe the outcome. This is the topic of Biondini and Mantzavinos' new paper and thus explores what actually happens. In two previous papers they laid the foundation and with another year of work they found the solution. "(...) We then used computers to test whether our math was correct, and the simulation results were pretty good -- it appears that we have captured the essence of the phenomenon." Biondini said. Their research has shown, mathematically, that different kinds of disturbances evolve to produce wave forms belonging to a single class. These are denoted by their identical asymptotic state.[4]

In the wild: white blood cell VS bacteria

By studying solitary hunters like tigers and bears a model was created. Using mathematical expressions the dynamics of a single predator hunting a herd of prey can be examined. The hunt is split into a diffusive part and a ballistic part; the former being the search for prey and the latter the chase that follows. By adding to this model, researchers from inter alia the National Institute of Chemistry in Slovenia and the Sorbonne University in France can now also analyse the way white blood cells hunt colonies of bacteria. They incorporated volume effects which means that prey can inadvertently get in each other's way and endanger their survival. One of the parameters used is the 'sighting range'; the distance at which the prey is able to see the predator. The researchers concluded that a hunter profits more from the prey's poor eyesight than from the strength of its own vision.

Figure 1: Artistic representation of a white blood cell engulfing bacteria[1]



"With the ever more detailed experimental study of systems ranging from molecular processes in living biological cells to the motion patterns of animal herds and humans, the need for cross-fertilisation between the life sciences and the quantitative mathematical approaches of the physical sciences has reached a new dimension," Ralf Metzler from University of Potsdam in Germany and head of the study, comments.[3]

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Recognition expert Prime Vision thinks out of the box

Primevision

Prime Vision, a Delft-based global expert in automation, processing and recognition solutions for the postal world, successfully introduced a Business Innovation and Development department. Under the name Prime Competence, the company is co-developing services with major postal operators all over the world.

The company has been working very closely with a couple of major posts on trialing and introducing new initiatives in all areas of postal operations. At Prime Competence, postal companies can develop and innovate new ideas collaboratively from the birth of an idea to proof-of-concept and through to deployment. This factor alone is unique for the postal and logistics market.

With so much innovative thinking, we are always looking for great minds with great ideas. Our teams are working on many emerging technologies as well as developing and applying our own award-winning recognition and integration technologies. If “high-tech” is your thing and you want an inspiring place to work, then consider Prime in your future planning. Come and talk with us now and find out more. In the meantime, let’s introduce you to some of our latest initiatives.”

In working with Prime Competence as a dedicated partner for innovation and specific initiatives, their clients can maintain their focus on daily operations, letting the Prime Competence team work in parallel to execute an innovation quick scan, design an innovation roadmap or come in-house to develop and execute a new business solution with the team.

A main focus area of Prime Competence is “Internet of Things” (IoT) solutions. IoT enables posts to think outside the box and introduce new products to complement their core activities. It’s still early days, however Prime Competence together with European posts developed the following concepts.

REFERENCE NETWORK

Prime Competence has developed a Reference Framework for posts new to the rapidly emerging IoT. The IoT is a network of physical objects — machines, equipment, vehicles and other items — embedded with electronics, software, sensors and connectivity that enables these objects to collect and exchange data to the advantage of the user.

The new Reference Framework sets out to provide guidance on the practical application of IoPT, with particular focus on the logistics function. Every post experiences common logistics problems such as undelivered mail, seasonal demand fluctuations, the availability of sufficient roll containers in the right places at the right times, and a lack of current location-specific inventory information with regard to moveable objects.

Knowing the location, route, load factor (by volume and weight) and other data about shipments and assets can be extremely valuable. Importantly, such capability can also facilitate additional revenue streams or business models. For instance, there is potential to offer deeper level track and trace capability, along with services such as live re-direct, and live collection/returns based on current and predicted location of mail delivery personnel and vehicles, potentially even using autonomous robots and drones in the mail and parcel handling process. The possibilities are almost endless.

A common enquiry from posts concerns the best technology to locate among other things, roll cages, a request which is part of the greater need to locate shipments and packaging resources, and develop tracking in real-time. With this in mind, the principles of the IoT Reference Framework address many issues, including target identification and localization, as well as data collection and exchange.





Aside from cost, there are multiple benefits that arise from implementing an IoPT strategy, such as optimizing the total number of assets, correct asset numbers in correct locations, optimized traffic flows, the opportunity to implement condition monitoring or predictive maintenance, reduced loss/theft of valuable shipments, saving on vehicle fuel, improved fleet productivity, volume per stream known in advance, and even learning of weather conditions on route. There is, in fact, almost no limit to the impact that the new IoPT Reference Framework could have across a postal organization, from doorstep to doorstep, through operations, to new service development.

SMART STREET MAILBOX

The good old mailbox has been a feature of our street scene for several hundred years, in fact as far back as 1653 in Paris perhaps! In all that time, the functionality has barely changed. Prime Competence sees this as a missed opportunity considering the growth of packets and small parcels and an increasing ease of being able to communicate with end-customers and drivers via their smartphone. Therefore the Business Innovation and Development team designed and developed modular features for the mailbox enabling real-time track-and-trace from the mailbox.

MAIL MAN

The team has been thinking about ways in which postal companies can make better use of the huge existing network they have and are now developing concepts that reach much further than just putting the letter in the mailbox. There is a potential for field workers to collect all manner of data while they are out doing their postal jobs and combine that with data collected by fixed infrastructures such as mailboxes and buildings. For example, information could be gathered on air quality, noise levels and traffic hot spots.

NEW WAYS TO ENRICH YOUR DATA BASED ON VISION

TECHNOLOGY

Track-and-trace for parcels is one topic, but also think about mobile property such as roll cages, post bags or even electric vehicles. Is there a strategy and means to keep track of these objects? Prime Competence started a scientific research in this area in cooperation with TNO.

ANYTIME

The vast majority of online buyers prefer to receive their products at home, even when they are not at home "Anytime". It is a 24/7 delivery and return solution at home. Authorized users have easy access to the secure storage via an app on their smartphone. A proof-of-concept is now underway at properties in The Netherlands in order to explore all aspects: technical, commercial and financial.

Prime Competence is also looking at using internal and external data to predict machine service life and implement predictive maintenance regimes to underpin quality and reliability.

The Internet of Things has so much to offer. These are really exciting times for the postal industry and everyone can benefit from this evolution.

ABOUT PRIME VISION

Prime Vision ranks among the top three players in the field of advanced recognition and sorting decision software (OCR software). The company is all about innovation in IT. On the development side they have some of the best brains in the industry busy developing new software and solutions built around recognition technology and data processing. Prime Vision is active in several markets with the primary focus on the global postal and logistics market.

Headquartered in Delft and from this office, our solutions are developed and delivered to their customers. Visit our websites: www.primecompetence.com and www.primevision.com.





Leonhard Euler

Marjolein Bouwmeester

I would like to start this article with a little correction. In the article of the last MaCHazine, I talked about Blaise Pascal as being the first in making the mechanic calculator. Until 1957 Pascal was indeed called the first. However, in 1957 there was a congress where was told otherwise. It turned out that the invention of Wilhelm Schickard of the University of Tübingen was the basis of the calculator. So Wilhelm Schickard should be called the father of the calculator.

After Pascal, who had a well known name, I will talk about another man who's name should ring a bell, at least when you're a mathematician. I am talking about Leonhard Euler. You could know him from his diverse innovative discoveries, for example in analysis, number theory, graph theory, applied mathematics, physics and astronomy and music.

Let's start at the beginning. Leonhard Euler was born on 15 April 1707 in Basel, Switzerland. Son of Paul Euler, a pastor of the Reformed Church, and Marguerite Née Brucker, a pastor's daughter, and oldest of two younger sisters and one brother. Not long after the birth of Leonhard, the family moved to the town of Riehen, where he spend most of his childhood.

His formal education started in Basel. He was sent there to live with his maternal grandmother. When he was thirteen years old, he enrolled at the University of Basel and three years later he received a Master of Philosophy with a dissertation that compared the philosophies of Descartes and Newton. At that time, next to his regular lessons, he was receiving Saturday afternoon lessons from Johann Bernoulli; Paul Euler was a friend of the Bernoulli family. Johann Bernoulli was then regarded as Europe's foremost mathematician. He quickly discovers incredible talent for mathematics in his new pupil, Leonhard Euler. Leonhard's father used to push him to studies that included theology, Greek and Hebrew, because of his wish for his son to become a pastor. However, Bernoulli convinced his friend Paul Euler that Leonard was destined to become a great mathematician.

De Sono, was the title of the dissertation on the propagation of sound which Euler completed in 1726. While working on that, he was unsuccessfully attempting to obtain a position at the University of Basel. He went on. One year later Leonhard Euler first entered the Paris Academy Prize Problem competition; the problem in 1727 was to find the best way to place the masts on a ship.


Pierre Bouguer, who became known as "the father of naval architecture" won and Euler ended up being second. After that year Euler won this annual prize twelve times.

1727 was also the year Euler moved to Saint Petersburg. He went to fill up a post in physiology, that was vacated by one of Bernoulli's two sons. Daniel Bernoulli took the position in the mathematics/physics division of his brother Nicolaus, who passed away. For the post in physiology, Daniel recommended his friend Leonhard. Leonhard was promoted from his junior post in the medical department of the academy to a position in the mathematics department. Euler mastered Russian and settled into life in Saint Petersburg. He also took on an additional job as a medic in the Russian Navy.

The academy Euler worked for was intended to improve education in Russia and to close the scientific gap with Western Europe. This wish made the academy especially attractive to foreign scholars like Euler. The academy possessed ample financial resources and a comprehensive library. Very few students were enrolled in the academy in order to lessen the faculty's teaching burden, and the academy emphasized research and offered to its faculty both the time and the freedom to pursue scientific questions.

Euler swiftly rose through the ranks in the academy. In 1731 he was even made professor of physics. Only two years later Daniel Bernoulli was fed up with the censorship and hostility at Saint Petersburg and left for Basel. And because of this Euler succeeded him as the head of the mathematics department.

Concerned about the continuing turmoil in Russia, Euler eventually also left Saint Petersburg. He went to take up a post at the Berlin Academy. He lived in Berlin for twenty-five years and wrote over 380 articles. The two works that made him most renowned were: the *Introductio in analysin infinitorum* and the *Institutiones calculi differentialis*.

After those twenty-five years, Euler went back to Russia. On September 18th 1783, after a lunch with his family, Euler was discussing the newly discovered planet Uranus and its orbit with a fellow academician, when he collapsed from a brain haemorrhage. He died a few hours later. In his eulogy for the French Academy, French mathematician and philosopher Marquis de Condorcet, wrote: *Il cessa de calculer et de vivre*: he ceased to calculate and to live. 

miscellaneous



Calendar



Area FiftyLAN

AreaFiftyLAN is the hottest gaming event of the TU Delft. This spectacular all-weekend event will take place from 3 through 5 June 2016. All students are welcome to bring their PC's or laptops to play their favorite games with their fellow students and friends. You decide what to play! There are also tournaments where you can win prizes!



Study Visit 2016 - Brazil

Once every three years our association forms a study visit committee who organizes a 3-week study visit to an intercontinental, magnificent destination. This time Globe will organize an extraordinary trip for 30 selected top students, mostly studying for their Master's degree. This year's destination: Brazil!



Freshman Weekend

Every year at the beginning of the academic year, an introduction weekend for freshmen students is organized. During this weekend, the new freshmen will get to know their fellow students in an informal way. Several teachers, faculty staff and academic counselors will be present this weekend, so that they can already get familiar with some of them.

June

- 3 - 5 Area FiftyLAN
- 7 T.U.E.S.day Computer Science
Excursion - ASML
- 8 SjaarCie BBQ
- 9 Double Games
- 9 Teacher of the Year Awards
- 10 CoH alumni drink at ORTEC
- 13 Chess Tournament
- 14 T.U.E.S.day lunch lecture
- 15 TransIP Table Soccer Tournament
- 21 T.U.E.S.day lunch lecture
- 24 Gaming Friday

July

- 4 - 25 Study Visit 2016 - Brazil

August

- 15 - 17 Freshman Weekend

