



# OCKHAM'S RAZOR

MAGAZINE H.V. OCKHAM - JANUARY 2018

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**Special thanks to:**  
Miko Elwenspoek, Ankit Anand

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## FROM THE BOARD

HiYee everyone and say hello to the 9th Board of H.V. Ockham. We are now busy running the association since September 19th and still enjoy the hard work tremendously. This is off course partly because off the great atmosphere our association has but also because we have five fun and hardworking people who are committed to take care of the association. We are here for you as an honours student so if you have any questions or an interesting idea for the association itself, we will always be available via: [board@hvockham.nl](mailto:board@hvockham.nl)

And now for a pretty picture so that you will recognize us in the hallway !

From left to right you can see:

**Luuk Buunk,  
Internal and Educational affairs**

He is simply the most hardworking board member of us all it seems, but most importantly he has a great love for the association. You will find him at almost all activities and if the occasion is right, with a glass of red wine.

[intern@hvockham.nl](mailto:intern@hvockham.nl)

Design Track

3rd year EPA (European and Public administrations)

**Idwer de Vries,  
Secretary**

He's our party hardy, but he does his tasks and is very efficient and creative while he is at it, especially if it comes to new and innovative ideas such as digitalizing our sell system.

[secretaris@hvockham.nl](mailto:secretaris@hvockham.nl)

Design Track

3rd year Civil Engineering

**Marleen van Hoorn,  
Chair(wo)man**

I am just plain crazy and often "a little bit" too loud, but with that comes a great deal of enthusiasm and effort put in for our association.

[chairman@hvockham.nl](mailto:chairman@hvockham.nl)

Design Track

2nd year Biomedical Engineering

**Pauline Oonk,  
Treasurer**

Although she is the most humble and calm person between the lot of us, she's is our silent power. Noone can work as neatly and precisely as her, which is great for our finances. Plus, she is not afraid of a party!

[treasurer@hvockham.nl](mailto:treasurer@hvockham.nl)

Science Track

3rd year Biomedical Engineering

**Varun Sudhakar,  
External Affairs**

He is our only international student, bringing some Indian culture. Not only is he not afraid to speak his mind, he's a great conversation maker as well, essential for being a good External.

[extern@hvockham.nl](mailto:extern@hvockham.nl)

Maths Track

2nd year Advanced Technology



Wanna meet us in person? Just walk by the association room, CiH209. That's the citadel, the University College building with the round tower. It is next to the Ravelijn and adjacent to the O&O plein. You could also come to our famous 2nd Monday of the Month Drink to meet us while enjoying a drink.



# EDITOR'S LETTER

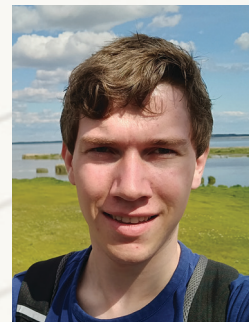
New students have found their way around campus and student life. Older students have been reminded of the struggles of tests, reports and exams. And now, as the second half of the academic year starts, some brave students have decided to join the honours programme of our university. If you are reading this in print, you are probably one of those lucky few.

What you are reading is the magazine of the honours association, H.V. Ockham. This piece of work will inform you about our association, for instance which committees you could join. You can read about the inspiration that led to the founding of the extracurricular programme. You can even read some carefully selected columns and articles that will inspire, inform, and entertain you.

This magazine is just one of the many things Ockham does for honours students. The Accie organizes activities, the SympCie organizes lunch lectures and the StuCie organizes a study trip. All of this is only possible because of the contributions of students and members of H.V. Ockham. Therefore, I would like to implore you to take this opportunity to check out the association. Moreover, if you have a good idea for an article for this magazine, or would like to help in making the periodical, do not hesitate to contact any member of the Editorial Board or the Board of H.V. Ockham.

On behalf of the rest of the Editorial Board and all the writers that contributed to the making of this magazine, I wish you a pleasant read.

Leon Smook  
*Editor in Chief*





## *A tale by Hammie McHamster: The legend of the BataBBQ*

Did you hear, did you hear, about the Batavierenrace this year?  
Legend says it will begin at night and end with beer.  
Ockhamsters will run to be the fastest critter known to race,  
And this year, it seems a certain owl might also join the chase.  
For the greatest prize of this collective feat,  
Will not be a medal, money, but juicy, delicious, meat.

And it is this my friends, that peaked the interest of Hammie,  
Ockhamster's most skilled,  
Not the most athletic, but adorer of that which is grilled.  
He will also be running in this legendary competition,  
For Hammie never gives up on his mission.  
He comes to smoke leaves and eat a mighty dinner,  
And he's all out of leaves, so he's aiming to be the winner.

But take care my friends, for this challenge is not for the faint of heart,  
So let me give you important information before you start.  
For if you didn't get the idea yet, you will have to run!  
Golly, isn't that lots of fun...  
However, this effort comes with payoff in every mile.  
It's healthy, fun with your friends, won't that give you a smile?

So fellas, be sure to join this extraordinary annual event,  
And truthfully, at the end you will be spent.  
But also overcome with a feeling of pride and delight,  
And from Thijs' mystery meat, you can take a bite.  
With our friends, all together we will celebrate our great success,  
So you will join us for the Batavierenrace, yes?





# Autonomous congestion

By Leon Smook

Some time ago, I visited the Apollo-Vredestein tire plant in Enschede. This seemed to be a regular plant visit; I would see mildly intimidating machinery, overly enthusiastic guides, and extremely annoyed personnel - because they are held up by the tour. And for most of the tour, it seemed to be like that.

Yet, when we reached the curing area - the part of the process where the tires are converted from a highly viscous liquid into a solid - things got interesting. We were instructed to stay within the yellow lines for safety reasons, however, we were not the only users of that space. Forklifts ran by beeping, breaking with screeching tires so as not to hit us. With every step I took, I got more and more convinced that there definitely was a possibility to be hit by a forklift. With every step I took, I got more anxious. With every step I took, I wished more and more that the tour would be over.

Low and behold, we reached a point where the drivers reduced their speed and the frequency with which they passed reduced. I felt safer. But not for long. Out of nowhere a yellow, square cart with a bright screen came headed for us. No beeping, no shouting, no driver, it just drove right at us. My fight-or-flight instinct started taking over, but it failed miserably as I did not move, nor did I hit the machine. Then our guide instructed us to move aside and the autonomous lorry passed without any problems.

I did not feel safer, as I saw more and more of these yellow driverless machines. I felt impressed by the state-of-the-art of this technology. How magnificent are these machines to transport semi-finished products from one place to another without crashing? How impressive is the organic flow of this fleet of yellow carts? How can they not bump into each other or into the personnel?

The latter question was answered rather anticlimactically. It did not matter how good the machines could drive by themselves. It did not matter how well they were programmed. It only mattered that there were still people in the factory. It only mattered that those people should not be killed by accident. Therefore, safety measures would stop the machine in case it (almost) hits something. This meant that even with this exquisite technology, autonomy, and programming, traffic jams still remained.



# Prague

## Bohemian City of Wonders

By Leon Smook

He sat down at his desk. Dusk had not yet set in, yet the window was located such that the room already was dark. A candle threw its flickering glow on the paper. On the corner of his desk there is a simple cup of ink. He dipped his pen in the ink. For some moments he stared at the paper - what to write? He recollected a conversation with a fellow student of law some years back. The dark room perfectly set the mood for the story. Then he started writing.

This is how I imagine Franz Kafka to write one of his first stories *Beschreibung eines Kampfes* (Description of a Struggle) in 1904. It would be one of the few works that were published during his lifetime, most of his work would be left to his friend Max Brod. He would publish these unfinished works after Kafka's death in 1924, disregarding Kafka's explicit instructions to destroy them in the event of his death.

Kafka's works often display characters in a surreal environment struggling with feelings of disorientation, their personality, and their senses. These elements are so characteristic to his works, that the term 'Kafkaesque' has been coined to describe these macabre, existential, and often internal struggles.

The existence of this term shows the profound influence this Prague native has had on literature and culture in general. Kafka is just one of many interesting, inspiring and influential people that have been born in this Bohemian capital. He was just one of the writers, composers, scientists and politicians that helped shape the world as we know it.

Besides Kafka, other artists also found inspiration in the city of Prague. The composer Antonín Dvořák spend most of his adult life in this city and created many of his musical artworks in this Czech place. Even Wolfgang Mozart had many of his best opera successes in this beautiful town.

Prague is not only of cultural significance, but also of scientific importance. Albert Einstein spent some time as a professor at Charles University and Johannes Kepler published his papers on the Doppler effect when he lived in Prague. What is more, the 1959 Nobel Prize for Chemistry was awarded to Jaroslav Heyrovský for his work on polarography.

Given the beauty of Prague, it is not surprising that many found inspiration to create intriguing artworks and ground-breaking research. Prague is home to the worlds largest castle - legend has it that the Rolling Stones liked the castle so much, they paid the \$ 32 000 price tag for the artificial lighting of the monument at night; one the most intriguing astronomical clocks; the impressive historical Charles' bridge - of which, according to the legend, construction started at 5:31am on 9 July 1357 (1357 9 7 5:31); and a television tower which is scaled by ten fibreglass babies. So if you want to get inspired, don't hesitate to Czech it out yourself!

Prague is definitely worth a visit. Therefore the Study Trip committee has decided that Prague will be the destination of this year's study trip. Below you can find some of the tentative details of the trip. If you are interested in joining, do not hesitate to contact any of the committee members of the StuCie or the board.

- Date: 9th - 13th May 2018
- Destination: Prague
- Costs: < € 300 per participant



# Committees of H.V. Ockham

Within our wonderful Honours Association, there are many volunteers that organise all the wonderful activities for our Honours students. The efforts of these volunteers are vital for the existence of the association and are widely appreciated within the Honours community. During the period that volunteers are active, they become a core part of the Honours community and gain various soft skills.

These volunteers are off course gathered in committees, which each have specific tasks and organise specific types of activities. In this article, you will find an overview of all the committees within H.V. Ockham. In case you are interested in joining one (or more) of the committees, you can contact the board of the association at any time!

## Media committee

The Media Committee (MediaCie) is responsible for the exchange of all information between the association, its members and the outside world. In practice this means that they, amongst others, manage the association's website and make pictures during activities.



## Activities committee

The Activities committee (ACCIE) organises the general activities of H.V. Ockham, both small and large. For example, they are responsible for organising the Dies Natalis, the yearly traditional lasergaming in Hengelo, and kicking off the Honours Kick-In. The ACCIE generally organises an activity once every six weeks.

## Experience committee

The Experience committee (ExperienCie) is responsible for this very magazine, Ockham's Razor. Members of the ExperienCie can write about anything they find interesting or help out with editing. Basically, the only limitation is the maximum amount of pages.





### Drinks committee

The Drinks committee (DriCie) organises the drinks of the association. Every second Monday of the month there is a drink in which Honours students have the opportunity to come together, quench their thirst and have a good discussion with each other. For some occasions, like an alumni drink or a summer drink the DriCie organises additional drinks.



### Symposium committee

The Symposium committee (SympCie) arranges interesting lunch lectures and workshops so that Honours students can develop themselves further next to their regular Honours courses. The type of workshop or lunch lecture that is being held is fully decided upon by the committee itself, creating the opportunity for the committee members to have a speaker of their liking.



### Study trip committee

The Study trip committee (StuCie) organises the study trip that allows Honours students to literally explore their boundaries. This year the trip has Prague as its destination. If you want to be part of the awesome experience of going abroad with your honours friends, be sure to let the committee (or the board) know you are interested.



### Batavierenrace committee

The Batavierenrace committee (BataCie) makes sure that the the Honours students have the possibility to join the Batavierenrace with their Honours friends! Just like last year, H.V. Ockham will join up with HCSA (the Honours association of Groningen) to create a team of talented and ambitious students that surely will surprise the other participating teams with its magnificent velocity!





# Broadening horizons through the foundations of science

I remember discussing teaching at different universities. These discussions only focussed on underperforming students. Often, questions that dominated the conversation were: 'What can we do for these students to help them complete their courses with sufficient grades?' Our best students should not be spoiled, 'they will find their way'. After all, did we, professors, not succeed in our studies, despite bad lectures and out-dated didactic methods? We did. We were smart and motivated enough to find our own way. Therefore, the argument goes - since we did not need extra attention 40 years ago - why would you, gifted students, need it now?

This argument came up in the beginning of the century and it strikes me as odd. Do we not support our best soccer players much more than we support the less gifted ones? Do we not send the most talented young musicians to the best institutes and give them lectures from the best teachers? Why do we not act similarly with our most capable students in sciences and humanities?

There is no reason. We just did not do this before. This raises the question: do universities have a climate that supports mediocrity? I do not think so: we professors love and admire our brightest students; we love to have them in our group doing assignments; we try to persuade them to do a PhD in our group; and we are gratified by the excellent pieces of work they create.

To bring about a change in mentality, we started to make plans for an honours programme at the University of Twente. These plans started in 2005, government funding was received in 2006 and the actual programme took off in 2007. This new excellence programme was based on four principles.

First, the programme should be interdisciplinary in several aspects. We wanted that the subjects that were offered were interesting for students from all departments. The topics should be such that an interdisciplinary approach is required and we wanted the groups to be composed of students from all disciplines.

There were several reasons for this first principle. The practical reason being that our university is small and that it would be difficult to offer honours programmes for the best few per cent of each programme, especially the programmes with 50 students or fewer. More importantly, we found it interesting to confront students with problems they did not encounter in their curricula; to show that problems can be approached from different perspectives; and to show that scholars with different backgrounds take an interest in different aspects of problems and accept different kinds of solutions. This approach fits very well with one of the central slogans of the University of Twente: "High Tech Human Touch".

Second, the programme should be challenging. Unfortunately, I did not (and do not) know what "challenging" meant for students. Piano sonatas of Beethoven are challenging. Maxwell theory is challenging. So rather, we opted for complex themes, hoping students would find them challenging.



Third, the first programme was on science (now called the Science Track). The idea was to show students how science is created; what kind of problems scientists struggle with; and how these problems are tackled, approached, and solved. Therefore, we thought that it would be challenging and interesting for students to read the original texts of important scientists. (This reading was done for the first ten generations. Now, this is replaced by a course called Origins, which deals with the emergence and development of our world)

Fourth, we were convinced that doing your own research would be challenging for everyone. However, we did not have the means to let students work in labs – and they worked in labs anyway. In regular courses, assignments often had clearly defined problems and students usually had a good idea of how to tackle those. Students were not confronted with the creation of those problems and questions and finding out how to approach that themselves, while that is exactly what we, professors, do when we write research proposals to get funds for our research. Therefore, we decided to let our students write a research proposal based on their own original idea. In my view, this formed the core of the first programme.

The other tracks were included as the number of students enrolling in the programme increased. In 2012, the Design Track was added and was organized based on the same principles (interdisciplinary, pursuing an original idea). In 2014, the Excellence Stream on mathematics (now the Math Track) was added. And in 2016, the programme was completed with the addition of a Philosophy Track – organized by philosophers, and a track in management, called Processes of Change. What is more, around 2014, the extracurricular options were increased with initiatives in the form of an honours programme for master students and so-called star programmes – which gave talented students the chance to deepen their knowledge in their own discipline – for certain bachelor programmes

Having worked in and on the honours programme for more than 10 years, I think it is a shame that the programme is only for a select group of students who get high grades. The programme has many elements that are important for all students, especially being exposed to a mix of disciplines. After all, most of our work as engineers happens in a setting where we have to collaborate with people from different scientific or cultural backgrounds. The emphasis on reflecting on the consequences of our work is in my opinion the most valuable aspect of the programme: everything we do will affect others. Academics are educated to become leaders in our society, and with this comes great responsibility.

Obviously, we have an effect on the problems themselves - since we identify them in the first place - and for this we are educated. However, I believe our responsibility extends beyond this. We affect society with our inventions and products. Let me give an example. In an edition of Zomergasten, there was an interview of a medical biologist who claimed that her work will ultimately lead to prolonged lifespan in humans of up to 130 years. She was asked about the consequences of this. When do we retire? Do bricklayers have to do their heavy work not for 45 years but for 110 years? Do teachers have to endure pupils' pranks for 100 years? Nowadays, teachers are burned out well before retiring age. The world population will double – how do we feed all these people? To all of these questions, she had no answer. A responsible engineer or scientist cannot ignore these questions and carry on, just because the problem is appealing. All our students should be trained to identify the risks and value the influence of their work and decisions on society.

It rests me to say that teaching in the honours programme was very rewarding. It was a great pleasure for me to work with bright, motivated students. And I learned a lot from you. Therefore, dear honours students, thank you very

**Prof. Dr. Miko Elwenspoek,** founder of the Honours programme, long time teacher for the Design and the Science track and recently retired Honours Dean.





# SCIENCE NEWS

## Man's best friend

Man's best friend, our beloved dog, is the joy of many households. These domesticated animals are very compatible with us, and stole our hearts a very long time ago when humans adopted them into our lives. But up until recently, aside from us being the ones feeding them and caring for them, there has not been much scientific support for the reason why dogs like us so much. In a recent genetics study with DNA samples from dogs and wolves, Van Holdt et al. discovered four key mutations on a gene called WBSCR17 and two transcription factor genes. When the first gene is deleted from one or two chromosomes in humans, it can lead to a hypersocial behaviour, where people are overly friendly. Mutations on these genes were found with many different breeds of domesticated dog breeds. Van Holdt would love if someone would inspect these genes in cats, as there might be a solution to the mystery of why some animals want to be our best buds. But whether their love is caused by genes or not, when you see a good doggo, give him a rub on the belly and a treat!

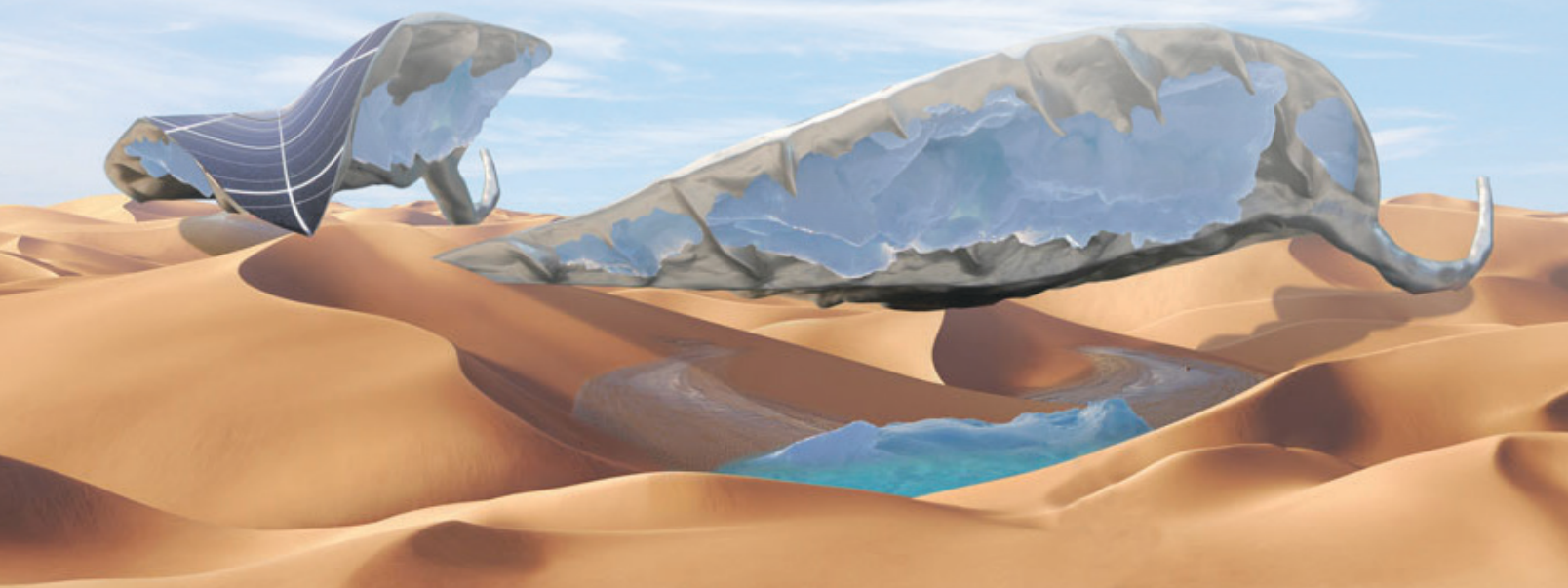
## Study crisis alert: alcohol will kill you

Are you coming to our Second Monday of the Month Drink? It might be a good idea to think twice about that beer or glass of wine. After a study of 550 subjects over 30 years, it was found that moderate drinkers have three times the odds of right sided hippocampal atrophy, which is an early marker for Alzheimer's Disease. For heavy drinkers, this was even worse. However, the biggest shocker of this research is that there is no indication of the positive effect of light drinking. Conventional wisdom states that sometimes having a glass of beer or wine might actually have positive health benefits, but there has been no proof of that in this study.

Small side note: Moderate drinking is classified around 14-21 units of alcohol/week, where beers and wines usually have between 1-3 units of alcohol per drink.

## Turning desert air into ice

What would you say when an artist comes up to you and says: I have a dream of creating ice in the desert. You would probably say, good luck with that. Ap Verheggen actually had this dream, after seeing how fast the glaciers are melting on the north pole, he actually felt like he wanted to do something about climate change. And while there are enough negative things, such as pointing out large amounts of carbon emission, he really wanted to create a positive focus for climate discussion. After grouping together with some science wizards, a few prototypes were tested together with the Dutch Ministry of Defence in Mali, to simulate effects of the desert with great results. Using solar panels and a cooling system, this dream of making an example for climate change debate may actually become a practical solution for water generation in dry climates in the future! Never underestimate the power of a passionate man with a dream.





# More than machines

A book review by Guido Ritsema van Eck

Continuing on the theme of artificial intelligence, I review Richard Yonck's *Heart of the Machine*. Compared to *Superintelligence*, featured in our last edition, it is a definite change of pace: Instead of superhuman analytical ability, *Heart of the Machine* focuses on artificial emotional intelligence.

It is commonplace to think of machines and emotion as incompatible, perhaps even mutually exclusive things. *Heart of the Machine* convincingly argues that this does not have to be the case, and is in fact very likely to change. As artificial intelligence and automation become more prevalent, people will come to interact with automated systems on a regular basis. These interactions could be considerably more pleasant and efficient if machines were able to recognise and respond to a person's emotional state. Additionally, emotion is an important means of assigning value to stimuli and information – a long-standing issue in machine learning. Reproducing this value assignment in machines could represent a significant leap in the development of artificial intelligence.

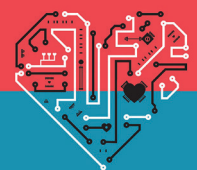
A little less futuristic, robots are already being tested for use in therapy for lonely elderly, and in teaching autistic children to interact socially. In the latter case, the predictable behaviour, endless patience, and relative simplicity of a robot proved to be a boon; because there was no distracting or confusing behaviour, autistic children found it easier to interact with a responsive robot and practice social interaction. This example also illustrates an important recurring point in *Heart of the Machine*: how we respond to machines is at least as important as how they are used. In a study on learning, students who got advice from a socially assisting robot 'tutor' while solving puzzles performed a full standard deviation above the mean when compared to an untutored control group. Surprisingly, this effect was observed regardless of the quality of the tutoring. Apparently, the presence of a tutoring figure, even if it is a robot, provides some cognitive benefit. Flipping back to the machine side of things, software capable of recognising emotional states could be used to evaluate a student's response to a lesson, and adjust the content to fit their learning profile.

If this latter proposal seems intrusive or even slightly dehumanising to you, that might well be justified: it is not all sunshine and rainbows in the land of artificial emotional intelligence. For instance, there is the possibility of highly personalised advertising, updated in real time on the basis of psychological profiles, body language, micro-expressions and even physiological measures. Advanced emotionally intelligent bots could be used to prey on the elderly and vulnerable through all kinds of online scams. More futuristic technologies, such as sophisticated brain-computer interfaces, could bring even more profound risks with them.

To Yonck's credit, he manages to remain fairly neutral throughout the book, avoiding the hopelessness of some AI analysts while staying well clear of naive optimism. *Heart of the Machine* is divided in three parts of six chapters each, documenting the history, current developments, and possible futures of affective computing. Every chapter starts with a bite-sized story introducing the topics of the chapter, then dives into the content. Chapters are weighty enough to read one by one, but also intriguing enough to go through several in one sitting. *Heart of the Machine* has left me genuinely curious about the future of artificial emotional intelligence, and if the subject is even slightly interesting to you, I recommend picking up a copy.

**Heart of the Machine**  
**Richard Yonck**  
**Arcade Publishing, New York**  
**First Edition: 2017**  
**312 pages**

**HEART OF  
THE MACHINE**



**OUR FUTURE IN A WORLD OF  
ARTIFICIAL EMOTIONAL  
INTELLIGENCE**

**RICHARD YONCK**

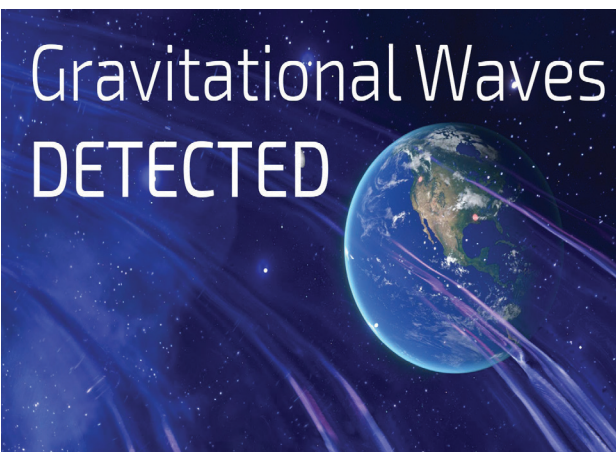


# A Physicist under construction

An article by Ankit Anand, graduated Bachelor Honours Student

17th August 2018 was not an ordinary day; after hanging out with two Russian friends of mine (from far east Vladivostok) the night earlier, it was not so easy to get up on time and make it to the conference. The PAX (Physics and Astrophysics at eXtreme) conference was taking place in NIKHEF for the past few days and I was attending it, but today was special. Unlike other days, today's focus was on instrumentation, which falls under my job domain. On the way to the Science Park Amsterdam, my friend Elena joked in her distinct Russian accent, "Don't sleep in the conference", and we laughed.

That very evening when she messaged back asking how it went, I replied "It was really great. The roadmap for the future in my area of research was presented; I met so many inspiring people. One of the people I met might win a Nobel Prize in Physics this year." The statement was not completely but a little random for sure. There were some speculations, but nothing could have been predicted, especially for Barry Barish, at that point of time. But hell yeah, he actually won! Off course, an interaction with a Nobel prize winner doesn't really transmit his talent into me, and by no means does it make me special, but it helps to keep yourself inspired.



The day was not special for that reason alone. The meeting was about to end when I walked upstairs towards my office and found all doors of the data analysis group closed. By then, I was experienced enough to speculate that we must have listened to another sound of the universe. Then Gregorio, a colleague and friend of mine from Pisa, walks into my room, shuts the door behind it. Looking at excited him, I asked, "Another detection?" "Not just another, it's BNS this time." I jumped off my seat. Binary neutron stars are special, as they reveal where the all heavy elements (including the gold in your cupboard) came from, and unlike blackholes, they also send out electromagnetic signals (including visible light). This first historic detection, commonly known as multi-messenger detection, was followed by thousands of astrophysicists across the globe and their electromagnetic telescopes. What a day!

I think I have tried enough to create a curiosity in you, so let's start from the beginning now. I Graduated from Honours in 2016 and from Advanced Technology in January 2017. At present I am doing MSc physics at ETH Zurich. And I have been asked to write this article to tell you about what happened in between.

By the habit of following extra credits, I accidentally graduated 6 months earlier than my classmates. I had not really planned what I would do afterwards. I had applied to ETH to do a Masters in Physics, which would start in September. I thought, I would just 'chill' for 6 months, but found myself bored within 2 weeks. Skipping several details and fast-forwarding a little, I applied to and got hired by Gravitational wave group at NIKHEF, Amsterdam. The project assigned to me was to develop an alternative method of cavity alignments.

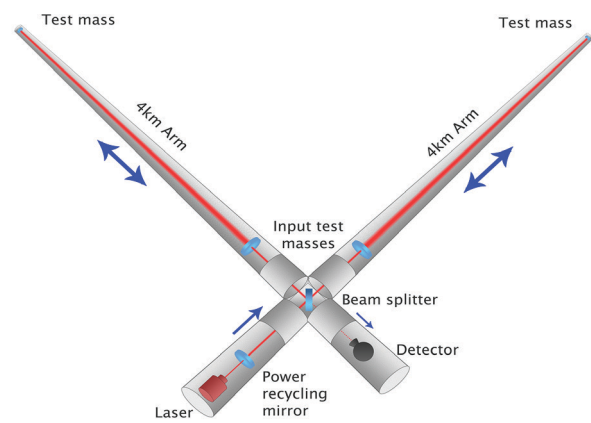
After a lot of buzz in media these days, gravitational wave detectors should not be unfamiliar to you. Gravitational wave detectors can detect movement in the earth which is a thousand times smaller than the size of a proton. It works with an interferometer whose arms are 4 km long. In an interferometer, you divide light into two paths using a beam splitter, let it bounce back through two mirrors, and recombine at the beam splitter. If the two mirrors are exactly same distance apart, they would form a brighter light (constructive interference); otherwise this intensity would be lower (or even zero, for destructive interference), depending on the difference between the arm length, which can be measured. The longer you make your arms, the more sensitive your detector gets.



The truth is, even 4km is not sufficient to get as low as I claimed earlier. The smart guys came up with the idea of increasing this length by just letting light bounce between two parallel mirrors to increase the effective distance. Just like you see (in principle) infinite image of yourself while standing between two parallel mirrors. This arrangement is called a cavity and those smart guys are also known as Rainer Weiss these days!



Now, you must be wondering, do you really see an infinite image of yourself. Off course not, because your cavity is not perfectly aligned (and light has a finite speed). So, the better aligned your cavity, the longer the light will remain trapped and the more sensitive your gravitational wave detector would be. The system currently used to do the alignment is known as Quadrant Photodiode and it works well, but off course there is always a room for improvement and I was hired to investigate this. One thing worth mentioning is that the idea I worked upon had its basics covered in the first module of math honours (Linear Algebra and Coding System), so attending honours turned out to be a great advantage in the beginning of my research career. As you might expect, I was not a big shot in this huge collaborative project. I was new, a learner, and I stayed there for a very short period. But the knowledge and experience I gained by working on a such giant project elevated my confidence level by several orders of magnitude.



After finishing my contract there, I moved to ETH to do my Masters. My main goal in coming here is to deepen my knowledge in mainly two areas of physics, Quantum Optics and General Relativity. The education here is very challenging. Unlike Twente, exams are not scattered throughout the module (or semester) but are all clustered at end of the semester (which is challenging because you will have to take exams of at least 30 credits all together at once). I opted an attitude of making myself exam independent over here; I don't know the outcome and I am experimenting, so I would not recommend it yet. I am now attending courses which are worth around double the amount of the credits I need for this semester, just for knowledge. I will make a choice of the examinations to appear for, during the exam season. I really like the environment here; everyone around is highly motivated. Facilities for cultural activities and sports are enormous at ETH (free of cost for students). The prom night I recently attended has seen ten thousand attendees, and is considered one of the biggest proms in Europe. It is commonly said that it's hard to socialize in Zurich, but I experienced the opposite. I heard Swiss people are like coconuts; hard to break into them, but once you are in, you are in forever. I didn't experience anything like that, I found Swiss people to be as friendly as others. The city and the university are full of internationals so even speaking English is not a problem.

Overall, ETH is a great place to study, and its physics department is performing cutting edge research. Based on my experiences till now, I can say that I am at the place I wanted to be. Still a long way to go in the direction of my career as a physicist! Meanwhile, I can feel glad about the fact that I am attending lectures in the same classroom where 120 years ago a genius was under construction!

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