Volume 11
Number 2
March 2017

ATTENTIE

Periodical of S.V.A.T. Astatine

Contents

The "ATtentie" is the periodical of S.V.A.T. Astatine, which is issued four times a year. The ATtentie is distributed among members of Astatine, sponsors of Astatine and employees connected to Advanced Technology at the University of Twente.

Volume 11 / Number 2 / Issue 46
Copies: 750
Date of issue: March 1
Editorial staff
Jasper Gerritsen • Editor in Chief, Layout editor in Chief
Frank Esselink • Editor, Layout editor
Kevin Rouwenhorst • Editor
Daphne van Dijken • Editor
Bart Nonkes • Editor, Layout editor
Jelle Slief • Editor, Layout editor
Laurens van der Wal • Editor, Layout editor
Yannik Wotte • Editor, Layout editor

Address
S.V.A.T. Astatine
t.a.v. ATtentie
Post office box 217
7500 AE Enschede
Tel. 053-489 4450
Bank: 1475.73.769 (Rabobank)
attencie@astatine.utwente.nl
www.astatine.utwente.nl

Printer
Inpakservice IJmond
Tel. 0251-272 430

With thanks
Eline Marsman, Lisette Groeneveld, Zahra van Egdom, Max Krakers, Haishan Cao, Marcel ter Brake, Douwe Schotanus, Hanneke Becht

If you want to contribute to the next ATtentie, you can send in articles via email: attencie@astatine.utwente.nl
Authors remain responsible for the contents of their works.
The editors preserve the right to modify or reject received articles.

Fresh

Astatine

Recurring

Editorial

Hi,

It's going so fast! We're already halfway through the year. I hope you have absorbed all kinds of knowledge and scored yourself a couple of ECs. We in the ATtentie have been entertaining ourselves, by writing lots of fun stuff.

As freelance journalists, it is not only our goal to investigate and create our own knowledge, but also to report on activities. Motivating others to write is an important but often overlooked activity!

This edition, we have lots of external articles. First off we have the recurring interview, this time with Hanneke Becht. The result is staggering!

I went to talk to Lisette about her time across the English Channel. You might think Dutch coffee is good enough for you, but the reality is different!

In our pursuit of increasing the reading material on research groups we also asked the folks at EMS to write something for us. Of course you'll also find the puzzle, cheerful chef (revamped!), and lots of Astatine news!

Enjoy and all the best,
Jasper Gerritsen, Editor in Chief

From the AT staff

Eline Marsman, Programme coordinator AT

Dear AT-students,
How exciting, my first contribution to the ATtentie on behalf of the AT staff! I hope you are all doing well. In this issue I would like to highlight some of the issues the AT staff is working on.

BlackBoard organization

At the start of the academic year we set up a BlackBoard organization for the AT programme. On this BlackBoard organization page you will be notified about all programme related information and events. Our goal is to keep you well informed about the programme.

Changes in the programme

As most of you may know, we are working on the study programme for the next academic year. The biggest change will be the opportunity to choose in module 6. Next year, you will be able to choose between the modules Materials Science and Engineering (AT), Physical Transport Phenomena (ST) and Systems and Control (EE).

Study guide

In previous years we distributed a study guide, which contained information about the content of the programme and other general information. We decided to reintroduce this study guide. The study guide can help new students with getting to know the programme. The study guide will give information about the Twente Educational Model, the content of the AT modules, an overview of previous years' bachelor's assignments and answers to frequently asked questions.

Clarifying procedures

There are many procedures and it remains a challenge to make them clear. What may seem straightforward to some may seem gibberish to others. We try to make the procedures more visible and understandable to you.

Questions or complaints

As staff we are always interested in knowing how things are going. If you have questions about the programme or procedures, do not hesitate to contact us. Your questions will give us insight in what should be made clearer.
Your opinion counts!
All in all, there are a lot of things we are working on. We hope that you welcome these changes. On behalf of the AT staff, I wish you good luck with your current challenges!

Astatine

From the Astatine board

Douwe Schotanus

It was a Friday, when the members of the candidate 10th board of Astatine were sent to the Intratuin for an extraordinary quest set out by their predecessors. This task was essential for their upcoming board year, and not to be taken lightly. As soon as they set foot in the store they were approached by a clerk and the rest is history.

When Bud first came to our association, in the summer of 2014, the candidate 10th board had the honour of taking care of her. On the picture you can see how the secretary of the mentioned board took the role of loving and caring mother of the 7th member of the Astatetten. After this wonderful sleepover Butt took her position in the windowsill. It's from that spot that she watched over the boardroom-mess, the board members and the lovely view of Enschede.

Over the span of two years she stood there, being herself, patient and always prepared to offer a listening ear. But after disaster struck and she fell ill, we felt the pain of her misery. A beautiful ceremony and deserved speeches were heold and our beloved and faithful friend was put to eternal rest.

Now the boardroom is full of life again as Budt's successor has taken sprout in a beautiful pot at our beloved association. We welcome Kacque as our newest companion and hope to share many great moments with him. May he be our prickling star on the horizon.

Politics

Dutch political leaders and education

Kevin Rouwenhorst

On March 15 the eligible voters have to make their decision for the coming years, but who should you choose to represent us? As a student you may be wondering what the people leading the major parties have studied during their younger years and how successful they were at this. A summary of the student lives for party leaders of key Dutch political parties is provided. Considering you find the educational career and side activities important factors in the decision making, that is. The summary lists the party leaders of the seven parties who scored highest during the elections of 2012.

To start off, let us consider our current minister-president, drs. Mark Rutte (VVD, Volkspartij voor Vrijheid en Democratie). After he finished his Gymnasium he considered the conservatorium, but he made a different decision. He was registered as a student of History at the University of Leiden, from 1984 until 1992 . Rutte claims to have spent five years on his actual study, whereas he spent three years on politics. From 1988 until 1991 Rutte was the national chairman of the JOVD (Jongeren Organisatie Vrijheid en Democratie), a liberal political youth organization. This position can realistically be claimed to be full-time and thus his claim of spending five years on his actual study can be accepted.

The party leader of the coalition partner, mr. dr. Lodewijk Asscher (PvdA, Partij van de Arbeid), studied Psychology and Law at the University of Amsterdam. In 2002 he promoted with a thesis on fundamental communication laws. He was 27 at that time and afterwards he became a teacher on information rights at the University of Amsterdam.

Only little is known about the educational career of Geert Wilders, the party leader of the PVV (Partij voor de Vrijheid). After he finished his mavo and havo education, he followed an education at the SOSV (Stichting Opleiding Sociale Verzekeringen) in Amsterdam. He was also in military service at some point.

The party leader of the CDA (Christen-Democratisch Appèl), mr. Sybrand van Haersma Buma, graduated at the athenaeum in Sneek. He studied Law at the Rijksuniversiteit Groningen between 1983 and 1989. After this he followed a course International Law at the University of Cambridge, after which he started as a staff lawyer. During his study

time he was a member of Vindicat, a popular student association in Groningen.

Drs. Alexander Pechtold, the party leader of the D66 (Democraten '66) boasts about taking longer for his study time. "Ich bin ein Langstudierder!" he exclaimed at the Malieveld some years ago. In 1985 he started a Laws study in Leiden, but one year later he switched to Art History. He graduated in 1996, eleven years later. He did not study the entire time, in between 1993 and 1996 he worked full-time at an auction house in The Hague. In total he was registered as a student for little more than seven years.

Emile Roemer, the party leader of the SP (Socialistische Partij), spent some more years than usual on his havo degree at the secondary school. Whereas five years is the regular amount of years spent to obtain this degree, Roemer needed eight years. He started in 1974 and finished in 1982. Afterwards he started studying at the pedagogic academy in order to become a teacher, which he finished within the regular three years.

From 1999 until 2004 Jesse Klaver, the party leader of GroenLinks, followed an education vmbo at the secondary school. In 2008, he finished his study Social Work at Avans University of Applied Sciences, after which he started a pre-master to be accepted to the Master Political Sciences at the University of Amsterdam, but he quit this study.

All in all it can be concluded that these leaders all took a different road to their educational career. It also shows that different roads can lead to political success, which is encouraging for everyone.

Interview

Interview: Hanneke Becht

Laurens van der Wal, Jasper Gerritsen

Hanneke Becht has been working at the UT since 1998. She gives lectures about finding and checking information. We decided to get to know her better.

Which study did you do?

I studied chemistry in Eindhoven in the seventies. Afterwards I was interested in process engineering and durability. In the end I graduated on modelling a biochemical reaction, using a supercomputer. Which then was published in the Jex, an outstanding chemistry magazine at the time.

Afterwards I did a PHD in physical chemistry, on solid state chemistry and reactions between solid substances. These substances react with each other according to a balance between thermodynamics and kinetics. At room temperature the kinetics are so slow that nothing appears to happen though. They discovered something weird, they had copper and silicon, and one copper behaved differently from the other copper, both did not behave the way thermodynamics predicted they would. There was a thesis written on this by someone who worked at the UT at the time.

I found out the problem was contamination on the surface, which was a new concept in 1983. At the time there were physicists that neglected 5% contamination, and there was almost no surveillance on the impact. I did research on it and found out that Copper-germanium behaved according to the rules , wrote a thesis on it and defended it.

Next I did a postdoc in Delft, because the solid-state chemistry was still a developing field. A friend of mine was a professor at the TU Delft, who invited me to assist there. I worked there on multiple reaction subjects for multiple applications, which are still used to this day.

What did you do next?

Next I joined a research unit called "Energy supply", where I worked on a pilot for a power plant producing 1.2 Megawatts, which uses multiple tonnes of coal each hour.

They researched a fluidized bed, an object with a cross-cut of 1 meter on a bottom with air holes through which you blow your reaction gas. You blow them through with such a force that the particles in the bed start to 'dance', which causes you to get a kind of fluid, consisting of grains of solid substance.

We put in coal and pumped gas through it. Normally you fluidize it with air, using oxygen and nitrogen to burn the coal, but our idea was to close the cycle, capture the carbon dioxide and pump it through while injecting oxygen and close the cycle, which is carried by the carbon dioxide without nitrogen.

The original idea, which never came to be, was to vaporize in the bed, and use the gas to power the generator. This was the first step to automate the cycle. With my background in chemistry I attempted to model this reaction alongside mechanical engineers. Together with the group we had some knowledge on how to automate the cycle, but nobody had precise knowledge on how to do it in actual practice.

We had a huge installation which we used as a prototype. So when we did the first test, we first cleared the hall it was in and closed all doors and opened the emergency escape, because we were injecting pure oxygen at 10 bar and 900 Kelvin. But when you use these gases, everything gets dusty very quickly, with a lot of soot particles, and to clean the installation we needed to cool it down first. But if it cools down we could not directly infuse the gas into the turbine.

How did you end up here?

When the project ended I was looking for another job, but universities deemed me too broadly educated and companies deemed me too academic due to all the projects I had done on the university. Then I found an advertisement for information specialist for the library, the library needed someone for chemistry.

So, I became the first information specialist. I thought about the information services and taught people to use them properly. By then my boss realized a digital library was needed, which we were going to do in projects. Since I was very experienced in projects I was going to help with that. I was one of the first who digitalized most of their publications. I worked on the layout of the website, the help pages, I worked a lot on all the early versions of the database.

Then the next step was finding out how to educate this. When I arrived, it was more or less 'button knowledge': if you knew how the buttons worked – in this case the catalogue – then you knew how it worked.

At that time the internet was rising, in '95 I had internet, but it was not very impressive, it was very messy, search engines were garbage. In '98 google started, around the same time I started working here. The chemistry department thought: "We surely have to do something with it." So I would give lectures to chemistry students on the usage of the internet.

There were some initiatives here and there, so I said: "I would like to have a computer lab." So in '99 the chemistry department was the first to have a computer lab. Very simple; a few computers, a computer for the teacher, which was facing the other way, and a beamer. It was very simple and worked like a charm.

You first started out just for chemistry, but how did you also end up lecturing for other studies?

At some point chemistry joined with

TNW, then the BMT and TG studies joined. At some point AT also joined. I grew along with all the studies that started while I was here. And the lectures grew from "How do buttons work" to critically evaluating the quality of data and that also leads to the controversy of 'fake news' and with malversations.

What is a malversation?

Fiddling with data, for example the test whether a new medicine is better than an existing one. They test the dosage; at low dosages nothing happens, but they realise there are some outliers above the curve. They realise the outlier is caused by men over the age of 65, so they change their hypothesis to whether it is better for men over the age of 65, which is fiddling with the information.

This is what I am teaching about; what are your questions, and how are you going to find answers? I'm not afraid of open internet, I'm not afraid of Wikipedia, but when do you apply which source? At AT I don't do a lot regarding this, but we have a lot of databases for scientific literature, patents, chemical numbers, and chemical properties. All these things have their own opportunities, pros and cons. This is what my job has grown into.

The newest development is data which we share with each other . So not only do we share the articles and conclusions, but also the underlying data. There are a few initiatives starting to do this, but how do you do this, and do it neatly? As a chemist, your lab journal is the basis, so start with that. I still note down in my old lab journal what I did, and what I still need to do. On these grounds you can share your data easily.

But then these malversations become public. Then you can say; "Hey, why only men above the age of 65?"

So then you have a problem when people don't share the information they don't want to share?

Then you have a problem, but it also stands out that people don't want to share that information. There are multiple commercial considerations to not share this, which can also be scientifically commercial. I have heard a researcher say: "I'm not going to publish my master thesis publicly (for which we also have a database). In it is the experimental setup, if it becomes public I lose my advantage over the competition. Because even scientists compete over grants.

So there are problems with this; on one hand the scientific ethics, on the other hand the commercial interests, which are the things I am working on at the moment, besides working on the collection. Knowing what everyone does is why I like education. Because much of the projects come from research, I know very well what is going on.

You have been a member of the URaad, can you tell something about this?

When I came here in 98' I was invited by the chairman of the Dienstraad, which is how I ended up there. We have been reorganised and reorganised again and after a while the URaad asked me to join them. I did that for some time, and after a while you become the 'set' person, because you are there for so long people start to always look at you first. So you get too much weight in the group. On the other hand I am chairman of the Dienstraad again.

Are there any points that you put special effort into during your time there?

Not really, the Dienstraad does not have that much power anymore, you are more of a conversation partner with the board with the background of an employee. So you have to track what is and what is not beneficial for the employees. I try to talk with the management before judgement to think about all sides of the problem, to make sure the proposition passes. I try to give advice instead of being negative, calling out everything that isn't right. We are trying to look at the organisation and not individual cases, the organisation here being the university.

I try to use this same mentality with students, when you write a report I am not trying to stomp it into the ground, that would yield nothing for you. I just take a look at what can be improved on, what are the consequences of what you do.

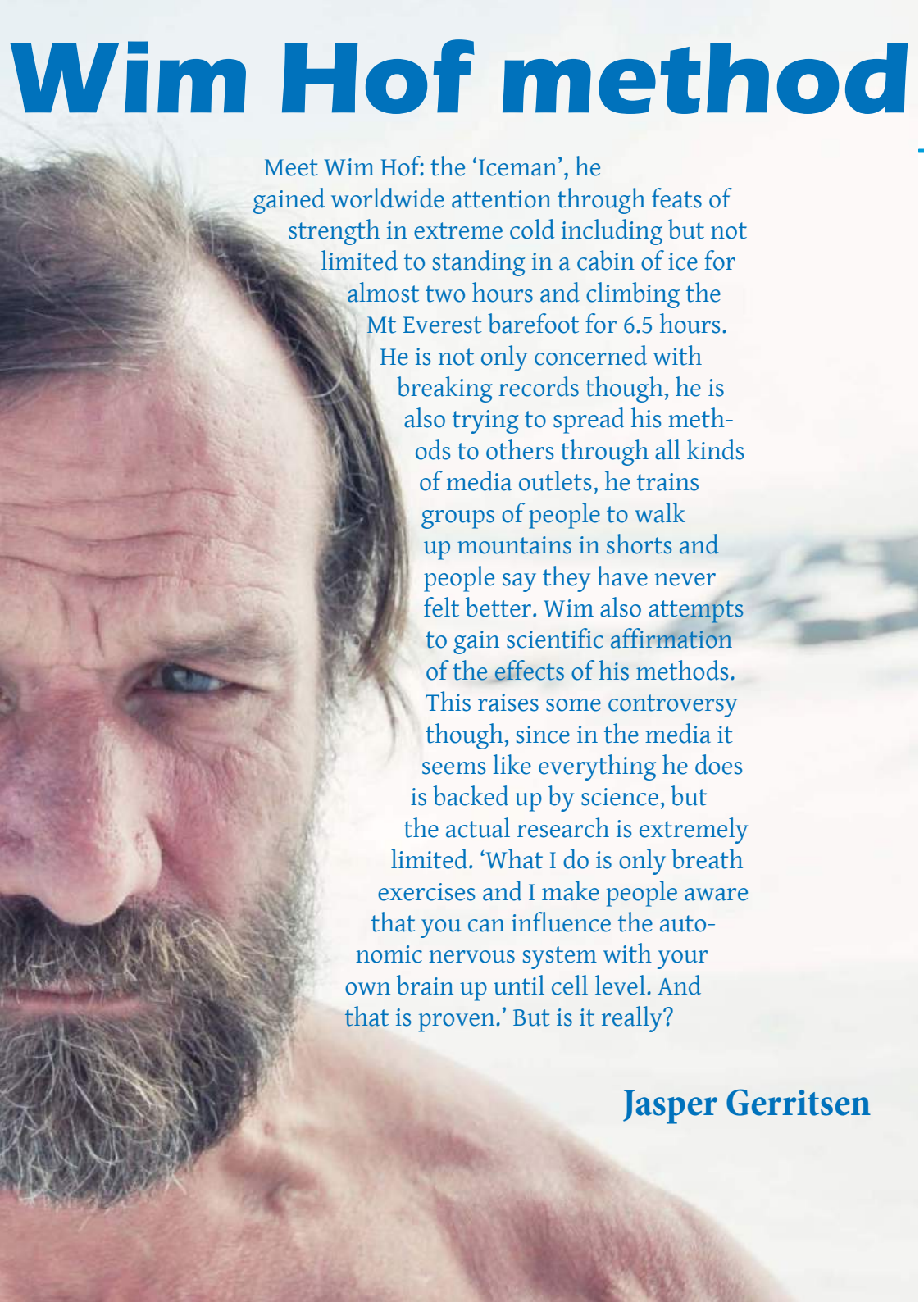
We talked a lot about your life focusing on the work part, are there any other things (eg. hobbies) which you do besides work?

I have been in the political field for the party "Groen Brabant", which was a lot about durability and such until the nineties. I stopped when I came here. I had even been a candidate for the Parliament's House of Representatives.

My biggest hobby at the moment is my vegetable garden. I also enjoy cooking with all the ingredients I get from my garden. I turn them into jam or I dry them, I don't put anything of it in the freezer.

I have two kids, which is a big hobby. They are 20 & 21 years old, they both study. My daughter does political science, but tries to change into econometrics. My son did a bachelor in physics and mathematics in Utrecht.

Wim Hof method

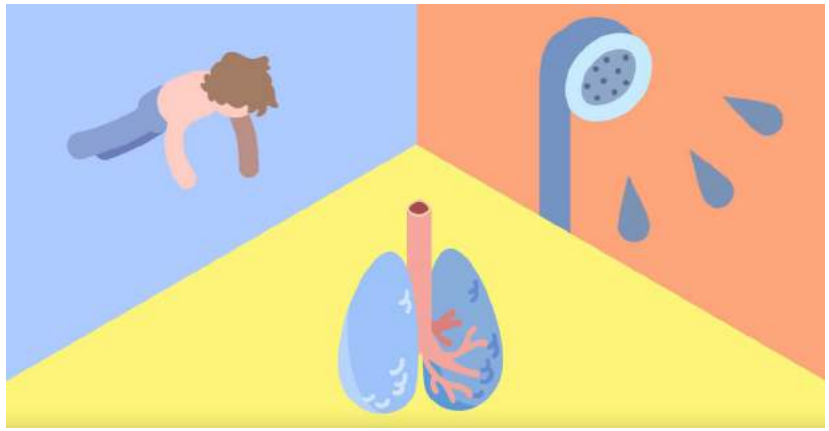


Meet Wim Hof: the 'Iceman', he gained worldwide attention through feats of strength in extreme cold including but not limited to standing in a cabin of ice for almost two hours and climbing the Mt Everest barefoot for 6.5 hours. He is not only concerned with breaking records though, he is also trying to spread his methods to others through all kinds of media outlets, he trains groups of people to walk up mountains in shorts and people say they have never felt better. Wim also attempts to gain scientific affirmation of the effects of his methods. This raises some controversy though, since in the media it seems like everything he does is backed up by science, but the actual research is extremely limited. 'What I do is only breath exercises and I make people aware that you can influence the autonomic nervous system with your own brain up until cell level. And that is proven.' But is it really?

Jasper Gerritsen

The method

To bring Wim's thoughts to a broader public a somewhat domesticated version of the method has been designed to be done at home, no mountains required. This Wim Hof method (WHM) consists of three parts. First a lot of breathing exercises, then there is exercise with yoga and meditation components, and finally cold showers.



Breathing

As for the breathing: you start by sitting or lying down and take very deep breaths in and small relaxed breaths out. Around 30 to 40, until you feel somewhat light-headed. Then finally you breathe out unforced for one last time and hold for as long as you can. When you feel the need to breathe again you take a deep breath for about 15 seconds or longer and start with the 30 breaths again. Generally you repeat this process a couple of times until your body starts tingling.

This method is called over breathing or hyperventilation and lowers the carbon dioxide levels in the blood, actually increasing the pH from 7.4 to a maximum of 7.75 measured in experiments. What it also does is widen the blood vessels in the body, however it actually narrows the blood vessels in the brain, limiting the amount of oxygen going into the brain which can cause dizziness, a feeling of euphoria and even fainting. This effect can be further increased by holding the breath, in a way it is similar to the effects of the choking game.

Next to increasing the pH level, after a few rounds there is a large spike in adrenaline levels as well as cortisol, the stress hormone. In a 2014 study by Kox et al. [1] a group of 12 healthy men in the age of 19-27 trained by Wim Hof beforehand was compared to a similar control group who didn't do the training. Both groups got toxins adminis-

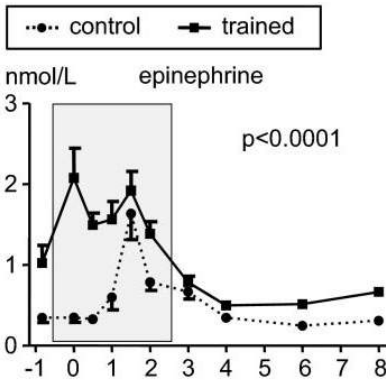


Figure 1: Epinephrine concentrations in blood of control and trained group. The grey area corresponds to the time window of breathing exercises by the trained group. Adapted from [1].

tered to them and while the trained group did breathing exercises during the experiment, the control group did not. In the trained group a very large spike in adrenaline was shown. The higher adrenaline gives rise to a higher level of proteins involved in slowing down the inflammation reaction and a lower level of proteins promoting the reaction as shown in figure 1. This was definitely a surprising result to the researchers, apparently the autonomic nervous system can be influenced by these breathing techniques. However they did not jump to conclusions, further research is necessary to explain whether this method can be used to help against auto-immune diseases like rheumatism and also on other age groups.
This suggests that there is some merit to the method; it definitely has impact on adrenaline levels. However, this research does not show that the mind has influence on these mechanisms, something Wim Hof never fails to bring up.
Something the researchers did conclude was: "in conclusion, the present proof-of-principle study demonstrates that the sympathetic nervous system and immune system can be voluntarily influenced through practicing techniques that are relatively easy to learn within a short time frame."

Wim Hof has used this breathing technique in a presentation to demonstrate the effects of his method. He lets the subject do a few rounds of the breathing exercise and measures the time the breath is held each time. The urge to breath is controlled by the level of carbon dioxide in the blood so it is no surprise that with each round the time without oxygen is increased. Wim Hof interprets this however as the body learning with each round, he implies that within 10 minutes the body is already adapted to this new technique. Then when the subject talks about the euphoria he says 'that's DMT!' while in fact it is not proven that DMT can be produced by the brain, it is pure speculation.

This is misleading in my opinion, since influencing the nervous and immune system through exercise should not be called voluntary as the effect is still very much indirect. Voluntary might suggest that something is accomplished solely through the power of the mind and indeed we find Wim hinting towards this view a lot.

Exercise

The second part of the method is exercise, for example pushups are recommended in between sets of breathing. Next stretching is advised, including some yoga poses. I'm obviously not going to argue against the benefit of exercise , although I do think it has something to do with all those people feeling so good. It seems unclear which part of the increase in overall happiness should be attributed to the exercise and which to the rest of the method.

Cold exposure

Finally the method suggests you end this morning routine with a cold shower. It is said that the cold shower starts to feel good after a while, because your body produces so much adrenaline and stress hormone starting up the fight of flight response. As mentioned before the research shows that the immune system is suppressed but also the pain receptors are less active. There is no strong scientific consensus on the medical effects of cold exposure. Otherwise the effects of cold exposure seem to be mostly similar to those of exercise. You feel energized after a cold shower, while you might feel sleepy after a hot shower. This should not be surprising as your body is working to keep you warm, so blood circulation goes up. This is not to say that cold exposure is bad, but there is no need to mystify the experience by saying it must somehow strengthen the immune response, just because it makes you feel good. This might be hard though for someone with the motto "feeling is understanding" (see figure 2).

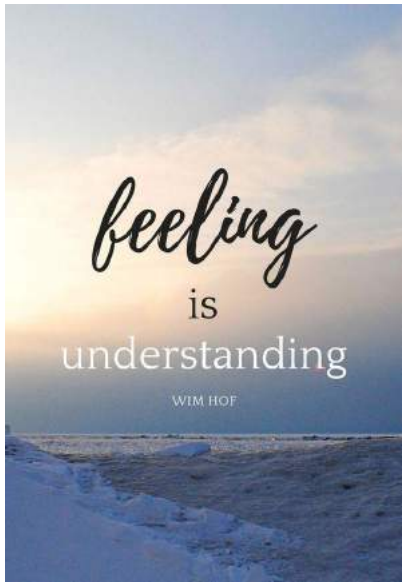


Figure 2: A visual representation of Wim Hof inspiring people to make corny wallpapers.

Wim Hof Method

The scientific basis

On the website of the family company Hof (innerfire.nl) you can find a document supposedly explaining the scientific basis for the entire WHM. It is written by Isabelle Hof, coordinator of academy and science at Innerfire, the company built around the WHM. She completed a psychology BSc and MSc at the University of Amsterdam, later specializing in clinical psychology.

After studying the document and its references however it becomes clear that there is not too much scientific about this document. It includes some research on the actual WHM, but also a lot of cherry-picked articles of which the connection to the WHM is not very clear at all. Take for example the following quote from the document: 'the WHM can be used to make the cardiovascular system stronger so the heart doesn't have to pump as much. Through cold exposure all muscles in the veins are trained so the blood can flow through better.' In fact there has been no research at all considering this. There is not a single citation for this statement, yet it is stated as an undisputed fact. This document uses a similar tactic to the one used in the media by Wim Hof: provide proof for one small part of the method and use it to provide credibility for another larger part. Depending on your level of trust and skepticism it is optimistic at best and deceptive at worst.

Conclusion

It is plausible that the Wim Hof method could prove useful in terms of reducing inflammation reactions and relieving stress. It is important however to remain skeptical and not to overstep the bounds of the current research in the light of optimism.

Bibliography

[1] Kox M, van Eijk LT, Zwaag J, et al. Voluntary activation of the sympathetic nervous system and attenuation of the innate immune response in humans. Proceedings of the National Academy of Sciences of the United States of America. 2014;111(20):7379-7384. doi:10.1073/pnas.1322174111.

Introducing: "The MaC"

Max Krakers

Dearest members of Astatine, you might have heard rumours about some strange new group called "The MaC". Or, you might have noticed new faces occupying the committee room, leaving you to wonder, "Who are these people, what is this MaC thing and why do I care so much about all of this?"

Well, wonder no more, because I have the great privilege of introducing the youngest Astatine committee: The Master Committee, aka The MaC, and its members: Alexander Dijkshoorn, Jeroen van Dorp, Max Krakers, Moritz Nunnenkamp, Yasser Pordeli and Hidde Veldkamp.

The Master Committee is a committee by master students, for master students, and it has various goals.

First, we would like to make sure that the growing number of master members still get something tailored to them out of their membership fees (next to the free coffee and tea). This will be done by organising career oriented events, such as case studies, or CV and internship workshops.

Our second goal is to allow master students to give something back to the association that has supported them during their Bachelors. We will do this by taking over the Master Information sessions and offering BSc assignment discussion events.

Last, it is a shared belief of us and the board, that the time has come to honour our predecessors and organise an Alumni day. Many of the events above are currently organised by the board and we will be working closely together with them, as responsibility for these events is transferred to us over the next year.

We hope that you will have the opportunity to enjoy some of these events, and if you have any suggestions, feel free to contact me or any of the other members.

Yours truly,
Max Krakers, Chairman of the Master Committee

Astatiny

DIES
Astatine's 12th birthday was on the 23rd of December 2016 and to celebrate a lovely party was held in the TAP on the 11th of January. The theme was the Wild West, so the TAP was decorated with not only a cactus and swinging saloon doors, but also plenty of mustache.

PROM
Wednesday February 15th it was time for prom, the once-a-year opportunity to show off your fancy white tie outfit and party with style. In a joint venture with our friends over at Proto the dance floor was filled.

A block of dry ice is sitting on a table when, as tends to happen, it begins to turn into carbon dioxide gas. After a little while, all that is left of the dry ice block is a cloud of carbon dioxide gas floating above the table. A nearby cloud of oxygen gas notices and says to the cloud of carbon dioxide gas, "Hey, I see you just underwent a phase change. How was it?"
The carbon dioxide gas responds, "it was sublime."

EXTREMELY DIFFICULT RIDDLE
Rick Astley will let you borrow any of his Disney Pixar DVDs except one. Which one?

What physicists say vs what they actually mean

"IT HAS LONG BEEN KNOWN"	I didn't look up the original reference.
"A DEFINITE TREND IS EVIDENT"	The data are practically meaningless.
"WHILE IT HAS NOT BEEN POSSIBLE TO PROVIDE DEFINITE ANSWERS TO THE QUESTIONS"	An unsuccessful experiment, but I still hope to get it published.
"THREE OF THE SAMPLES WERE CHOSEN FOR DETAILED STUDY"	The other results didn't make any sense.
"TYPICAL RESULTS ARE SHOWN"	This is the prettiest graph.
"THESE RESULTS WILL BE IN A SUBSEQUENT REPORT"	I might get around to this sometime, if published/funded.
"A CAREFUL ANALYSIS OF OBTAINED DATA"	Three pages of notes were obliterated when I knocked over a glass of beer.
"AFTER ADDITIONAL STUDY BY MY COLLEAGUES"	They didn't understand it, either.
"THANKS ARE DUE TO JOE BLOTZ FOR ASSISTANCE WITH THE EXPERIMENT AND TO CINDY ADAMS FOR VALUABLE DISCUSSIONS"	Mr. Blotz did the work and Ms. Adams explained to me what it meant.
"A HIGHLY SIGNIFICANT AREA FOR EXPLORATORY STUDY"	A totally useless topic selected by my committee.
"IN MY EXPERIENCE"	Once
"IN CASE AFTER CASE"	Twice
"IN A SERIES OF CASES"	Three times
"IT IS BELIEVED THAT"	I think.
"IT IS GENERALLY BELIEVED THAT"	A couple of others think so, too.
"CORRECT WITHIN AN ORDER OF MAGNITUDE"	Wrong.
"ACCORDING TO STATISTICAL ANALYSIS"	Rumor has it.
"IT IS CLEAR THAT MUCH ADDITIONAL WORK WILL BE REQUIRED BEFORE A COMPLETE UNDERSTANDING OF THIS PHENOMENON OCCURS"	I don't understand.
"A STATISTICALLY-ORIENTED PROJECTION OF THE SIGNIFICANCE OF THESE FINDINGS"	A wild guess.
"IT IS HOPED THAT THIS STUDY WILL STIMULATE FURTHER INVESTIGATIONS IN THIS FIELD"	I quit.

NOTICE OF ANNEXATION
In a message to all nanotechnology MsC students their attention has been drawn to the fact that their territory now belongs to S.V.A.T. Astatine. This diplomatic relation has been legitimized by a handshake between the glorious leaders of both studies.











PINNEN
JA GRAAG



WANTED

Joule-Thomson Microcooling (EMS)

Haishin Cao, Marcel ter Brake

For many electronic devices, colder is better. At lower temperatures, electronic devices such as infrared detectors and low-noise amplifiers (LNAs) operate with a higher signal-to-noise ratio and better overall performance than they do at room temperature. Superconducting devices such as superconducting quantum interference devices need extremely cold temperatures to operate. However, existing cryogenic coolers are very large compared to sizes of these devices to be cooled and mismatch the small cooling power requirements of these devices. In order to allow more widespread use of these electronic devices, micro-sized cryogenic coolers need to become cheaper and more reliable. Addressing this challenge, the cooler research of the chair EMS focuses on the miniaturization of Joule-Thomson (JT) cryogenic coolers. When combined with a sorption compressor, a closed-cycle cooler without containing moving parts can be obtained. Such a cooling system is virtually vibration-free and potentially has a long life-time. In EMS, the miniaturization of JT cryocoolers was has been investigated since 1995. The development of cryocoolers includes the development in fabrication technology and thermodynamic modelling. Development of fabrication technology went through three stages, namely,: handmade, semi-micromachined, and fully-micromachined.

Linde-Hampson cycle with Joule-Thomson expansion

Fig. 1 schematically shows a Linde-Hampson cooler which is used in a closed-cycle system, for instance for cooling a detector. A working gas is compressed isothermally and then expanded adiabatically over a throttling flow restriction. In this expansion, the gas cools by the Joule-Thomson effect and (partially) liquefies [1]. The liquid absorbs heat

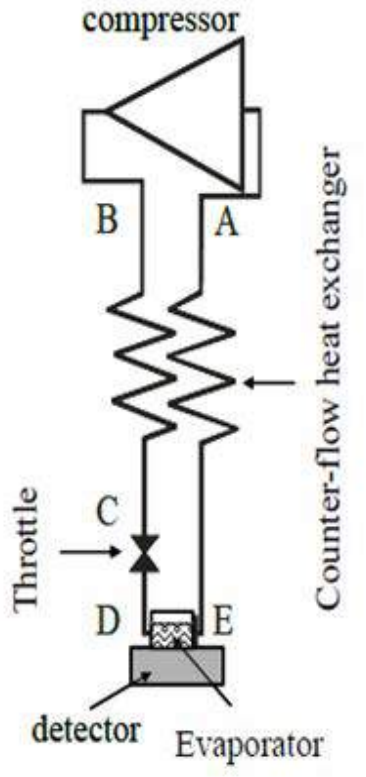


Figure 1: Schematic of a Linde-Hampson cooler using Joule-Thomson expansion

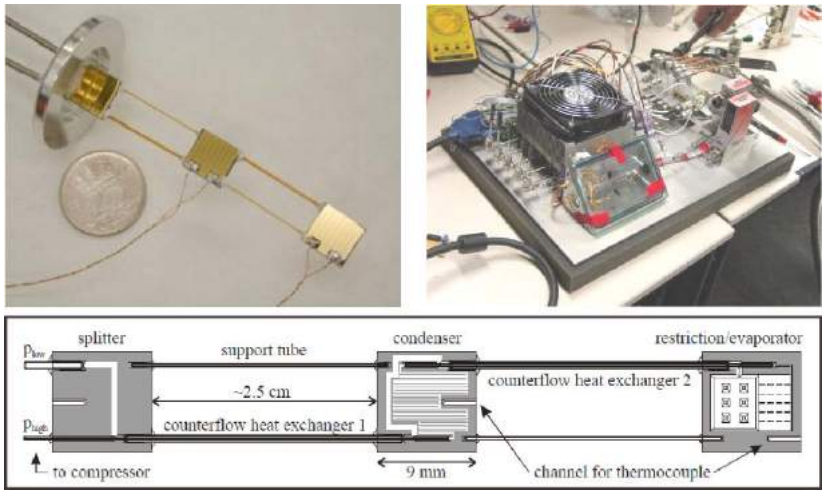


Figure 2 Photograph of handmade microcoolers (left) and cross-section of the cooler with connectors and JT-valve tuning possibility. (The inset is stretched in the radial direction)

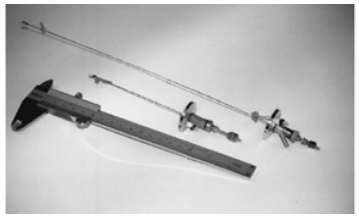
from the detector which causes the liquid to evaporate. The cold vapor flows back under low pressure to the compressor via a counter-flow heat exchanger (CFHX). In passing the heat exchanger, it takes up heat from the incoming high-pressure gas that thus is precooled on its way to the throttle.

Handmade microcooler

In two handmade microcoolers (see Fig. 2), a tube-in-tube counterflow heat exchanger (CFHX) was used, one with a length of 270 mm, the other 105 mm [2]. The tubes were made of fused silica glass with inner/outer diameters of 0.1/0.36 mm and 0.53/0.67 mm, respectively. The restrictions of the coolers can be tuned at the room-temperature side of the cooler. Operated with nitrogen gas between 0.1 and 10.0 MPa, the lowest temperature of 82 K can be obtained by both coolers with different mass-flow rates.

Semi-micromachined cooler

In the semi-micromachined cooler (see Fig. 3), the flow splitter, condenser and restriction/evaporator were micromachined, whereas the heat exchangers still were glass tubes [3]. The cooler was combined with a sorption compressor and in that way produced a closed-cycle cooler system. The cooler was operated with ethylene and delivered a cooling capacity of 200 mW at 170 K, while it was precooled to 238 K with a thermoelectric cooler.



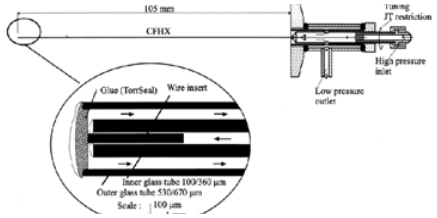
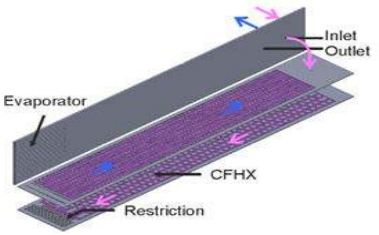


Figure 3 Photograph of the semi-micromachined cooler (top left), a closed-cycle cooler system consisting of the cooler and a sorption compressor (top right) and the cross-section of the cooler (bottom).

Fully-micromachined cooler

Cooler with single-stage expansion

The cooler with single-stage expansion consisted of a stack of three glass wafers (see Fig. 4) [4-7]. The high and low-pressure lines (rectangular channels) are etched in separate glass wafers with supporting pillars for keeping the maximum stress within acceptable limits. These gas channels are separated by a middle glass wafer, thus constituting a CFHX. One end of the CFHX contains inlet and outlet ports for gas connections and the other end consists of a restriction and an evaporator. Operated with nitrogen gas between 0.6 and 8.0 MPa, a cold end temperature of 100 K was obtained with cooling powers in the range of 10-130 mW, depending on the size of the restriction and the cooler. When the cooler was operated with methane gas at a low pressure of 0.4 MPa, a cold end temperature of 140



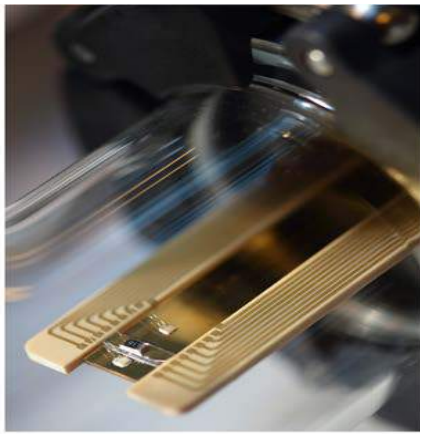


Figure 4 Photograph of a cooler with single-stage expansion (top left), exploded view of the cooler (bottom left) and the cooler mounted in a vacuum chamber for characterization measurements. The cooler has a size of 60 x 9.5 x 0.72 mm3.

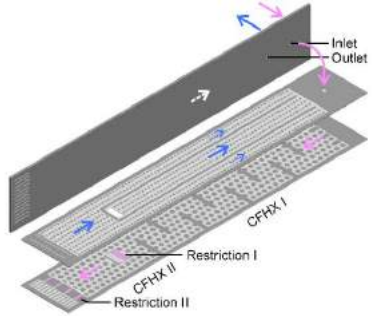


Figure 5 Photograph of the cooler with parallel two-stage expansion (left) and exploded view of the cooler (right). The cooler has a size of 60 x 9.5 x 0.72 mm3.

K can be obtained [8,9]. The cooling powers were in the range of 28- 110 mW, depending on the high pressure, the size of the restriction and the cooler.

Cooler with two-stage expansion

In a basic JT cooling cycle, the pressure drop in the low-pressure line of the counter flow heat exchanger (CFHX) causes a higher pressure at the evaporator than the ambient outlet pressure of the CFHX. This results in a much higher cold-end temperature than the temperature that would correspond to the boiling point at ambient pressure.

A cooler with a parallel two-stage expansion is an ingenious way to reach a more substantial pressure drop and thus a lower temperature without a loss in the gross cooling power of the cooler (see Fig. 4) [10]. Compared to a cooler with single-stage expansion, the cooler with two-stage expansion can provide cooling powers at two temperature levels. The cooler of Fig. 5 was operated between 8.0 and 0.1 MPa with nitrogen gas. It cooled down from 295 to 83 K, and had a cooling power of 88 mW at 85 K with a temperature at the first expansion position of 120 K. In changing the temperature at the first expansion position, the cooling power can be exchanged between the two expansions.

Two-stage cooler

The JT expansion process generates cooling only if the initial temperature, prior to expansion, is below the maximum inversion temperature of the working fluid. As a rule of thumb the maximum inversion temperature is about 10 times the normal boiling point of the working fluid. Thus the expansion of gases such as nitrogen, methane and ethylene at ambient temperature will generate cooling but hydrogen, neon, and helium will not. In order to reach temperatures near the boiling points of the latter three gases, a precooling stage is required

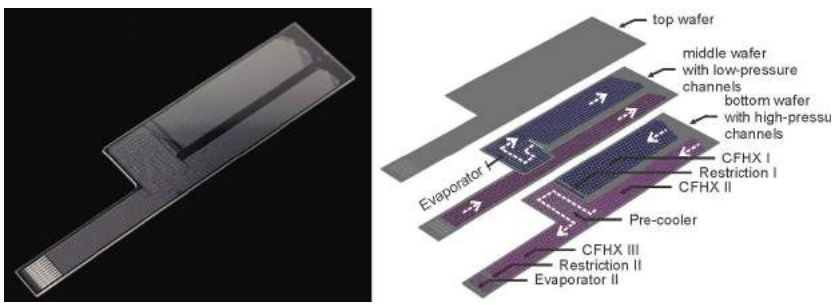


Figure 6 Photograph of the two-stage cooler (left) and exploded view of the cooler (right). The cooler has a size of 90 x 20.5 x 0.72 mm3.

to precool these gases from ambient temperature to a temperature below their respective maximum inversion temperature. Therefore, a two-stage cooler was designed, manufactured and operated with nitrogen gas between 0.1 and 8.5 MPa in the first stage and hydrogen gas between 0.1 and 7.0 MPa in the second, see Fig. 6 [11-13]. The two stages cool down to about 94 and 30 K, respectively. In changing the pressure settings, the cooling power can more or less be exchanged between the two stages. These typically range from 21 to 84 mW at 95 K at the nitrogen stage, corresponding to 30 to 5 mW at 31-32 K at the hydrogen stage.

References and further reading on microcooling

1. D.V. Schroeder, An introduction to thermal physics, Addison-Wesley, 2000, section 4.4, pp.137
2. Holland H J et al. 1998 Cryogenics 38 407-10.
3. Burger J F et al. 2001 Cryocoolers 11 551-560.
4. Lerou P P P M et al. 2005 Cryogenics 45 659-69.
5. Lerou P P P M et al. 2006 J. Micromech. Microeng. 16 1919-25.
6. Lerou P P P M et al. 2007 J. Micromech. Microeng. 17 1956-60.
7. Lerou P P P M et al. 2007 Appl. Phys. Lett. 90 064102.
8. Derking J H et al. 2012 Int. J. Refrig. 35 1200-7.
9. Derking J H et al. 2012 Rev. Sci. Instrum. 83 045117.
10. Cao H S et al. 2016 Int. J. Refrig. 69 223-231.
11. Cao H S et al. 2012 Cryogenics 52 51-57.
12. Cao H S et al. 2013 J. Micromech. Microeng. 23 025014.
13. Cao H S et al. 2013 J. Micromech. Microeng. 23 065022.
14. Cao H S et al. 2013 Appl. Phys. Lett. 103 034107.

Imperial College? Brenter: Brexit

Lisette Groeneveld

While the world was still shocked by the Brexit, I was busy performing my Brenter. Some of you might still know me, for others my name is already unknown. I am Lisette Groeneveld and I graduated from AT last summer (2016). At the moment, I am pursuing my Master's degree in Computing Science at Imperial College London. And let me tell you, Imperial is kinda very cool!

Though I have to admit, studying at Imperial means stepping up your game (at least for me). Substantial amounts of coursework, coding in the labs every day, no falling behind whatsoever, and worst of all, no retakes! I have (not completely voluntarily) said goodbye to last-minute work and have a tight schedule to follow. To be fair, these are the things I was expecting and the things I signed up for. It's the environment with other likeminded and passionate people that keeps you motivated every day, something very precious.

Furthermore, living in London is amazing. There are a lot of beautiful places to visit and there is always something to do. Imperial College is located next to the Royal Albert Hall, Victoria and Albert museum, Science museum, Hyde Park, all beautiful places to visit a mere 3 minutes away. The pros of being an Imperial student are very clear. Every week so many companies visit the campus (free lunch!) and I have yet to be declined from any company event I signed up for using my Imperial e-mail.

But you might be interested in how I ended up here, right? Well, for me it was never really clear where my specific interest lied (a feeling I think most of you are not unfamiliar with). Without knowing what I wanted to do specifically, I started my search of Master programs abroad. The field of Computing on itself had never attracted me. I mean, it's the type of stuff that the nerds do in their basement surrounded by bottles of Mountain Dew, right? Well, I couldn't be more wrong. As I read through the course lists of several programs I started to realize that I found these topics extremely interesting. Then I started to analyse the courses we'd had during AT and I realized that the courses of AT where we did a bit of coding were actually my favourites (if I may call programming in MATLAB coding ;)). Apparently, I enjoyed computing without even realizing it! I decided to dive into this new field, dedicated my BSc thesis to neural networks and a few months later I was on my way to start my Computing degree at Imperial College London.

Why Imperial you ask? Well, Imperial was the only university with a specific Master program tailored to students with a different, non-computing, background. Perfect for

a newbie like me!
However, I did not only apply to Imperial. I had multiple offers at different places in the world. I would like to advise any of you thinking of going abroad as well, not to hesitate and apply for foreign universities. I did not know what to expect at all when applying, but if your grades match their criteria, you really have a good shot at getting in!

To give you an idea of the things I am doing here, I would like to share with you one of the projects I am currently working on. It is called the 'Circle of Opportunity' and will be an interesting proof of concept regarding philanthropy.

There is this interesting technology that has gained a lot of attention and support called the Blockchain. You might have not heard of it before, but there is something extremely similar that you probably have heard of: the Bitcoin. Basically, these are the same technologies. The core idea behind these technologies is a distributed ledger of unchangeable, digitally recorded data.
Wait, a what?!
Let's see what that means. Currently you have a bank account at some bank. You TRUST the bank to do your transactions for you and handle your money. The bank has the complete power to do everything they wish with your money. Though they might not legally do so, they still could.

Now, is there a way to surpass this necessity of a third party you must trust? Some brilliant people have thought of an idea that does precisely that! It works as follows. Instead of only the bank holding your account records, everyone holds your records. Every single person sees all the transactions you made and you see all the transactions of everyone else. This data (with all transactions that ever took place between everyone) is stored on everyone's computer, so the data is always accessible by anyone, not only by some third party. Also, the data is immutable. If you were to succeed in changing the data on your computer, it wouldn't be accepted, as it doesn't match up with the data on all the other computers.

Alright, so we have the data stored everywhere, now how do we add data i.e. make a new transaction? We need to add it to the data stored on all the computers. Ensuring this is done correctly is quite a challenging task. I won't go into detail here, but please look into Blockchain further if it interests you, as there really are some very clever solutions to tackle this problem. IBM has a nice introduction to Blockchain that you can check out [1].

For the project I am developing, we want to set up a new charity based on the Blockchain technology. One of the major problems nowadays with charities is their lack of transparency. Does your money really go to the children in Africa, or does your money go to the new BMW of the CEO? You have no idea. There have been cases where donated money never reached its intended destination, making donating less and less attractive to the general public. We strive to tackle this problem with the Blockchain technology. As explained, the full records of all the money transfers would be visible to everyone, making it impossible to hide where the money is spent on. Precisely the transparency we are looking for!

The cause for the charity will be to grant everyone the opportunity to go to university. We will develop a platform where anyone can donate to help the students presented on our website. You could compare it to a GoFundMe page for the students, but in our case the student won't be able to run off with the money and do something else with it completely. To keep it sustainable, the students that have benefitted from the charity are asked to donate as well, creating a circle where the money that is initially invested can help multiple students in the long term.

It is a very interesting project to work on. It does not only have computing complexities, but quite some social and legal complexities as well. It is amazing to see how many people are willing to help with this, not only Imperial staff, but also companies wanting to invest, making me believe that we might actually be able to launch it someday!

So, this is a quick snapshot of what I have been up to since I closed the chapter of AT. I have had a lovely time in Twente and AT had given me enough background to be able to start in the computing field, and for that I am very grateful.

Cheers,
Lisette

[1] http://www.ibm.com/developerworks/cloud/library/cl-blockchain-basics-intro-bluemix-trs/index.html

Singapore: Southeast Asia's Disneyland

Jelle Slief

Singapore – one of the most densely populated countries in the world. The country is so small it consists of little more than its capital – and only – city. The city-state's population is roughly equal to that of the entire country of Finland, crammed into an area half the size of the province of Utrecht. By comparison: if everybody on earth would live that close to each other, the entire world population would fit into the country of Egypt. Did you think the Netherlands are crowded? Try visiting this wonderfully strange place!

When approaching Singapore by air, which is situated on a small island directly south of the Malay Peninsula, the first thing you notice when looking down is the sheer amount of ships in the sea surrounding the city. The clear blue water is riddled with them, big and small. This is not very surprising once one learns Singapore has the second busiest seaport in the world. This is only one manifestation of its incredibly strong economy, which came to be in part due to its rich history. So before we consider all the different aspects that make Singapore such an interesting country, let's take a look at its history first.

History

The first written accounts of the island nation are of the kingdom of Singapura, which was established at the beginning of the 14th century as a trading port city. As the era of the great European discoverers began, the Portuguese were the first to discover and establish connections with the kingdom. As discoverers turned into colonizers, throughout the period between 1400 and 1800 control over the island was mostly held by the Portuguese and Dutch forces, with several short breaks of rule by different Malaysian kingdoms. Eventually however, both the Portuguese and Dutch powers were surpassed by an even greater force: the British. They seized control over the (still relatively small) settlement of Singapore in the early 1800's. They established it as a capital city in the surrounding region of British India, after which the population boomed. Many immigrants, mostly Chinese, came to work at the rubber plantations the British started there, and soon the island became a global center for rubber exports.

During WWII, Japan invaded British Malaya and seized control of Singapore, where a large British naval base was situated at the time. Several thousands of British

soldiers were forced to surrender, and many of the Chinese immigrants in the colony were executed. Winston Churchill called the defeat "the worst disaster and largest capitulation in British history".

When Japan surrendered after WWII the British repossessed Singapore, but a Chinese communist-led guerilla war in the 1950's eventually led the British to grant full internal self-government to the country, with exception to defense and foreign affairs. In 1963, Singapore joined the new federation of Malaysia, but due to many political and economic disagreements the Malaysian parliament voted unanimously to expel Singapore from the countries. No Singaporean delegates were present when this decision was made. Thus, Singapore gained its somewhat involuntary independence in 1965.

Shortly after this, the country co-founded the ASEAN, the Association of Southeast Asian Nations. The countries first prime-minister's emphasis on rapid economic growth, support for business entrepreneurship and limitations on internal democracy shaped Singapore's policies for the next half-century, moving the country from a Third World economy to First World affluence in a single generation.

Current situation

When Singapore secured its self-governance in 1959, it did so in the form a parliamentary republic, which it remains to this day. This entire period, starting from the very first elections in '59, the People's Action Party (PAP) have won control of the parliament with large majorities. This sounds very sketchy indeed, but the elections are clean. According to the Corruption Perceptions Index, Singapore is consistently perceived as one of the least corrupt countries in the world, along with New Zealand and the Scandinavian countries.

There is no independent electoral authority however, and the government has strong influence on the media. Freedom House ranks Singapore as "partly free" in its Freedom in the World report, and The Economist ranks Singapore as a "flawed democracy", the second best rank of four, in its "Democracy Index". More than 80% of the country's population expresses trust in its government, which is one of the highest percentages in the world. Singapore's political stability and harmonious social order is unrivaled, which is demonstrated by the World Justice Project's Ruleof Law Index ranking Singapore among the top countries surveyed with regard to "order and security", "absence of corruption", and "effective criminal justice". However, the country received a much lower ranking for "freedom of speech" and "freedom of assembly". All public gatherings of five or more

Singapore: Southeast Asia's Disneyland

people require police permits, and protests may legally be held only at the Speakers' Corner. Along with this, there is a mandatory death penalty for murder, as well as for certain drug-trafficking and firearms offences. Someone carrying 5 grams or more of weed with them classifies them as "dealer" according to Singaporean law, and can receive several years in prison. According to Amnesty International, Singapore has "... possibly the highest execution rate in the world relative to its population".

These policies sound strict and possibly even a little extreme, but the results are there to show for. Along with South Korea, Hong Kong and Taiwan, Singapore is one of the original Four Asian Tigers, having undergone rapid industrialization and maintained exceptionally high growth rates (< 7% /year) between the early 1960's and 1990's. It has become a world-leading financial center and for several years has been one of the few countries with an AAA credit rating from the "big three", the highest there is. For comparison, Belgium, France and the UK "only" have a rating of AA. The Singaporean economy is known as one of the freest, most innovative, most competitive, most dynamic and most business-friendly in the world. It has been ranked as the easiest place to do business in the world for the past decade.

Experiences

During my travels I have had the pleasure of visiting Singapore, and it is a curious place indeed. The huge and concentrated economic wealth can be found back in many aspects of daily life in the city. Not only is the city skyline dominated by skyscrapers occupied by business HQs, banks and fancy hotels, the cost of living for regular citizens is extremely high – like the skyscrapers. Few people own cars because it is simply too expensive. One of the most popular means of transportation is the taxi, but even most taxi drivers lease their cabs from the government.

In much the same way the city skyline is dominated by skyscrapers, the main streets of the city are dominated by malls. Situated at the corners of roughly every other block, they are literally everywhere. And they aren't filled with grocery stores either; Swatch, Chanel, Dior, Hugo Boss, Patek Phillipe, Versace, Ralph Lauren, Louis Vuitton and Gucci are just a few of the names that seem to reoccur in every one of them. Singapore is a popular tax haven, so the elite from surrounding countries (many from China, but also Korea, Japan, Malaysia, Indonesia, Thailand and more) come to live here. The ones that do not live in Singapore permanently fly out to spend their fortunes in Singapore's malls and casinos.

Singapore: Southeast Asia's Disneyland

And after a long day of intensive shopping, you can sit down and relax on a nice terrace on the main street, maybe even order a beer. Don't be surprised when the bill comes back and reads US$18, - though!

It's always hot in Singapore – it has a tropic climate after all – so you would expect the people living there to be used to high temperatures. That doesn't stop them from air-conditioning everything however! Walk into a cinema or hotel lobby after having wandered through the city in 30-plus degree temperatures, and suddenly a chilly 18 (!) degrees feels like stepping into a snow storm.

The influences of Singapore's strict government are visible on the streets as well. For such a huge city with so many inhabitants, the streets are surprisingly clean. No wonder when there are several thousand-dollar fines on littering and chewing gum has been banned. The streets are busy with people, but everyone behaves. When necessary, people queue up in an orderly fashion. Everybody respects the people around them – quite different from other cities with comparable populations.

Singapore has a rich history of trading, colonialism and immigration, and as a result is now an extremely multicultural country. The real 'Singaporean' does not exist, he (/she/it/...) is a mix of Chinese, Malay, Thai, Indo, Vietnamese, Japanese, Caucasians and a whole bunch more. On the street, a white businessman in expensive suit talking on his phone is seen passing an Indian lady in beautifully colorful traditional clothing. A flashy billboard showing the newest Sony technology stands by the side of the road, next to a large traditional Chinese restaurant with large wooden pillars showing intricate carvings of dragons. All these different cultural aspects merge together in a single unique and interesting stew.

There may not be a single 'Singaporean', but this combination of eastern and western, traditional and modern, black and white, along with all the excessive wealth and ridiculousness – that to me is truly, uniquely Singapore.

Regardging the unreal sense of order and control and extravagant wealth that seem to surround the city, I once heard somebody refer to it as "almost like Disneyland". And to me, that sums it up perfectly. A small, isolated, orderly piece of land amid the chaos that tends to be Asia, filled with all sorts of wonders that should not be but are. To me, Singapore really is Southeast Asia's Disneyland.

Project

Cooling contest thermodynamics

Yanniek Wotte

The whole Diagonal was packed with people. Hundreds of eyes stared at screens showing the temperatures of water in containers behind them. Panting students could be heard over the noise of compressors that would have made any chainsaw blush: Then the first temperatures started to rise drop.

These were the first minutes of the final contest in the STUPID project that the first years in our study pursued for the past module: Creating a STUdent Powered Ice Device, or short, STUPID.

It was of course not all that bad:
In the Thermodynamics module the Advanced Technology and Applied Physics students were made comfortable with not only the laws of thermodynamics and theoretical concepts of engines and refrigerators, we were also taught how to create our own refrigerators from scrap!

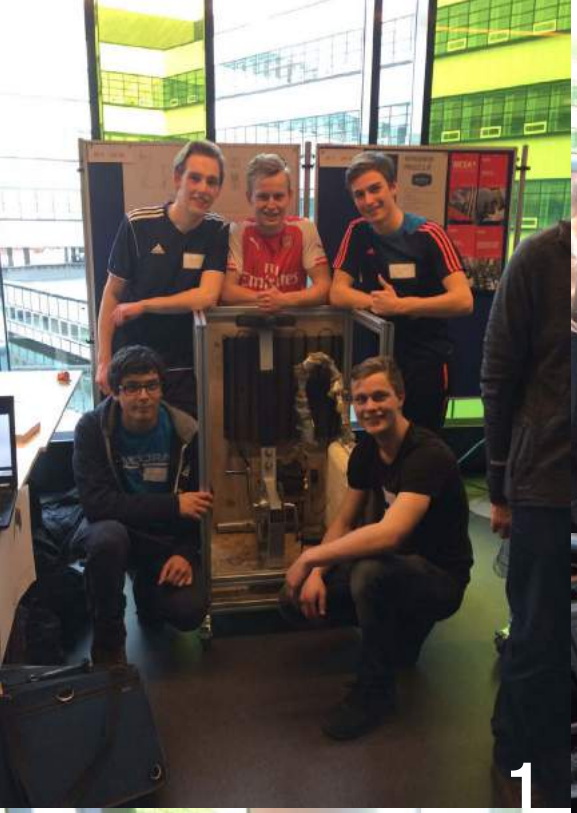
These refrigerators had to conform to certain regulations. They needed to stay within boundary sizes, they were not allowed to use anything but the raw strength of students as their power input and last but not least, they needed to be able to cool down a litre of water in the final contest.

Eventually, the first place went to AT Group 1, which reached a temperature of 14°C. A decent result, especially keeping in mind that their cooler was not working for a third of the match as the conveyor belt slipped off with particularly bad timing, like many mishaps of the day (see 1).

They were followed by the AP Group 2, that, regardless of ending up at a lower temperature of 12°C, exceeded the boundary conditions by a few centimetres, nonetheless doing a great job (see 2).

But for a lot of groups, the days after the project focused on error analysis. Many of the cooling devices had surprising breakdowns in the course of the 30 minute contest: pedals that got through weeks of testing broke off, reservoirs started leaking, compressors overheated (maybe to the relief of visitors, in case of Team Chainsaw's Device (see 3)). These incidents made this project a valuable learning experience, rather than a breakthrough in human powered cooling devices.

And a fascinating project it was, for sure. Among the cooling systems used were not only thermoelectric coolers using Peltier elements or vapour compression cycles with various refrigerants.
The most interesting devices used vortex tubes (see 4) or acoustic cooling (see 5)! Please turn over for the pictures.



Recipe

Cheerful Chef

Zahra van Egdom

¡Hola!, so this time I have a recipe but with a twist, we all know tacos and this is my version of sweet savoury taco but then in different way then normally, we are going to make Chicken tacos with peach salsa. I will include a recipe to make the tortilla's as well.

Tortillas (for 4)
- *250 grams of flour*
- *½ teaspoon salt*
- *3 tablespoons olive oil*
- *180ml water*

Combine the salt and flour.

1. Combine the water and oil.
2. Pour in the liquid mixture in the flour and
3. knead the dough until smooth let it rest for 15 minutes.
4. Divide the dough into 8 parts and form balls of the dough.
5. Roll out the dough balls into tortillas on a floured surface.
6. Heat a pan on middle heat and cook the tortillas on each side for about 30 seconds.

Taco filling
- *2 chicken fillets*
- *Lettuce*
- *Cucumber*
- *Onion*
- *Bag grated cheese*
- *Avocado*
- *Tomato pasata*
- *Large can peaches*

1. Put the chicken fillets in a pan and fill it with water until the chicken is covered, put in some stock powder and let it cook for about 20 minutes or until chicken is done.
2. Slice the onion, cucumber and peaches fine and put in a bowl and set aside, the peach salsa is ready.
3. Slice the lettuce.
4. Hollow out the avocado and add a tablespoon olive oil and water.
5. Put in some salt and pepper and mash the avocado to make the guacamole.
6. When the chicken is cooked take it out the pan and shred the chicken with two forks.
7. Pour in the pasata in the pan with the chicken water and put on a low heat and throw the chicken back in and cook for a few minutes.

Everything is now done and you can build your taco, enjoy!

Puzzle

Sequences

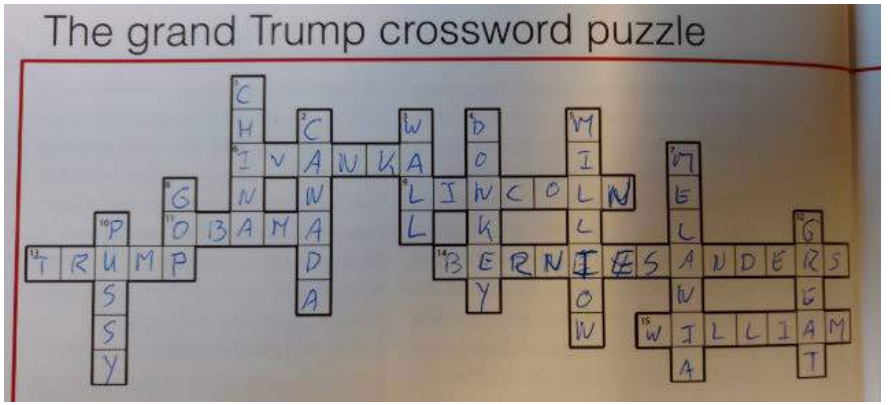
Complete the following mathematic sequences. To find the final answer, don't forget to use modulo 26 on each answer.

2,	3,	8,	30,....
1276,	316,	76,	16,....
12,	26,	54,	110,....
4,	13,	6,	10,....
536,	556,	563,	565,....
987,	1597,	2584,	4181,....
7,	8,	5,	5,....
0,	2,	4,	6,....
283,	185,	307,	179,....
1,	3,	6,	10,....
4,	8,	16,	32,....
3,	7,	9,	13,....
271,	277,	281,	283,....
19,	20,	21,	4,....

If you think you know the answer, send your solution to attencie@astatine.utwente.nl and perhaps you will win the cinema coupon!

The winner of last year's Trump crossword is Rens Werink! You can see his solution on the next page.

Solution puzzle 11-1



ACROSS

6 This 2016 presidential candidate's daughter has followed both her mother's career as model and her father's as businesswoman (6)

9 The first president representing the same political party as Donald Trump is also a car brand (7)

11 Trump's main adversary during the 2016 presidential race was Secretary of State for what former president? (5)

13 Wind instrument (abbrev.) (5)

14 This 2016 presidential candidate would have been better off running for president in Europe (13)

15 Donald Trump's main competitor's husband's full first name (7)

DOWN

1 Melania Trump's husband is known to have an obsession with this Asian superpower (5)

2 A large portion of the US population wants to move to this country should Trump with the 2016 election (6)

3 Donald Trump wants to build this brick structure between the US and Mexico

4 This animal represents the political party opposite to that of Donald Trump (6)

5 Fred Trump gave his son a small loan of one of what natural number in dollars? (7)

7 What do Donald Trump and the country of Slovenia have in common? (7)

8 Donald Trump's political party (abbrev.) (3)

10 What animal has Donald Trump been known to grab? (5)

12 This is what Donald Trump wants to make America again (5)

Do you pursue a technical master's degree?

apply for the ASML Technology Scholarship

receive 2 years of financial support

follow an extensive development program

and get to know ASML from the inside

ASML pushes technology further to print microchips features that are finer, to accelerate artificial intelligence, to make robots understand humans, to let robots help in healthcare. Interested?

Apply for the ASML Technology Scholarship before April 14. workingatasml.com/scholarship.

ASML

Be part of progress