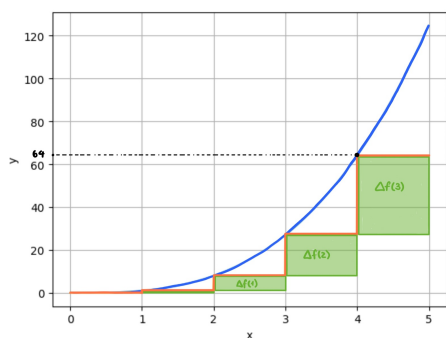# Periodiek

Recurring at regular intervals Issue 2024-2

Umbral Calculus

If you add two heaps of sand together, you still have one (larger) heap of sand. So does that mean 1+1=1? For their First-year project, Annika, Vilte, Oliver, and You investigated Umbral Calculus its respective Delta Operator

Perio Interview: Marcello Seri

Have you heard about the lecturer with a podcast? Marcello Seri is known for teaching Hamiltonian Mechanics, Spectral Theory, and Analysis on Manifold. In this issue of the Periodiek we interview this beloved lecturer and get to know him a bit better.

Meet the board

Recently installed and hard at work. If you haven't met them yet, it is time you do. Each board member introduces themselves and shares a little about themselves.

In this Periodiek

From the Editor in Chief

We are happy to deliver a jam-packed issue of the Perio*diek*. In this issue, we got a lot of pieces from many contributors, you can read more about Annika's first year project, cook a new recipe from VSA, and learn more about the Aurora Borealis in our collaboration with Sirius A.

If you want to contribute to the periodiek as well, send a mail to perio@fmf.nl or check out page 32.

Last year, you might have been part of a survey previous academic year regarding the government's stance on language in academia. You can read the results on page 16.

Those of us who were among the lucky few to join KBE to Vienna and Trieste might get nostalgic reading about the trip. The rest of us will have to read in envy.

Robert Mol

From the Board
Extern

AUTHOR: **A. SCHMITT**

Hello there, I am Aurélien and I am no longer a kandie. It's quite hard to believe I could have pronounced this sentence without being frowned upon by the now old board...

The kandie period was indeed something. It was a weird experience during which I learned a lot, mainly by means of hazing from B65, who, at some points, was giving me the impression of a Big Brother watching my every step and picking up on my ever-slightest mistake. Although this description sounds rather daunting, the strange fact is that I enjoyed it. I relished in the peculiar ambivalence of what it is to be a candidate board member. On the one hand, I was being given tasks of great importance requiring maturity and responsibility, on the other hand, I was being treated like an immature child who has no idea of what the "adult world" entails. This period having come to an end, all that remains to say is a big THANK YOU to B65 for trusting me and my fellow board members could survive the candidate period and teaching us the art of managing an association. That being said, I am now board, and this is where the real game begins. For it is no longer a game.

We were installed only a few days ago and are still adapting to the reality of what the title of "bestuur" entails. The fate of the FMF lies in our hands and we are determined to make our association flourish! All of us are working hard and judging from our past meetings, things are going quite well so far! From my part, this period is rather a busy one.

As Commissioner of External Affairs, my duty is contacting companies, and this is the prime moment of when to do that. I am thus in the flow of writing email after email, getting excited when a reply presents itself and even more so when it results in a meeting. This process has made me dig deeper into the world of industry, letting me discover the sheer number of companies a person with a technical education could end up working at. It's quite fascinating. Being extern is also a sort of game. It's a game of persuasion, of diplomacy and of finding which of the many qualities of our graduates could be the most interesting for a given company. The fact that Physics and Mathematics are very general and versatile degrees with no strictly determined career path makes it even more challenging and exciting. Hence externing is fun! Q.E.D.

"Being extern is also a sort of game"

The funny thing is, that my other position, Commissioner of Educational Affairs, is quite dual to that of the extern. I am also busy with emailing, but within the realm of academia. I have always found the contact between students and professors important, and I am happy to see most of them are quite enthusiastic about it. Though the amount of work has been smaller compared to my other position, I am very excited for the upcoming events I have organized so far! I have been interested in digging deeper into the academic world as well and now that the opportunity has presented itself, I can't wait for what is to come!

Figure 1: Aurélien at the GMA

From the Former Board
Chair and Extern

AUTHORS: **F. KUENEN, A. VALEA**

We never thought we would experience parenthood in university. Most students would do anything in their power to avoid a child. However, through our board year we got to become parents if only for a few months. Now, if this is still too elusive, choosing, teaching and preparing a candidate board for the next year is quite scarily similar to raising a child. Let us take you through our unexpected and peculiar parenthood experience.

In the beginning, like most couples do, we really desired them. Quite arduously. And after some failed attempts, as life goes, we finally got them, with only one miscarriage. Now, usually young parents don't have to deal with 5 newborns at once. But life is not easy for a board member. And so, we embarked on a quest to raise these people and let them become what they are today.

Newborn

We had to cradle our newborns and make sure we teach them how to speak and when to speak, as you do with a baby. They struggled quite a bit, sometimes letting out more than they should, sometimes not getting what we tried to tell them but, in the end, they started to walk and talk in a sufficient way. Most of all, we realised how unprepared we actually were as a board and how many things we still had to prepare and figure out such as documents, meetings, positions, timelines.

Toddler

In this phase, we shared with them the fun parts of life such as contis, kandi announcements, WiSO, SP↑N. They were so excited about all of this, that it brought back to us the experiences we used to have and made us join them in their joy. It brought fresh life to our board year, making our final struggles and burdens less heavy.

Teenager

In our own teenage years we started to make our own choices and plans. And we were relieved to notice our own children doing this as well. They picked up the things we taught them very well and only a few mistakes were made, with a common factor in all of them being alcohol. As we (unfortunately) have experienced this as well we knew what to do. We decided to be the cool parents and joined them in their fun.

Figure 2: Femke and Andra during the Valentine's Borrel

Young adult

As they started to become more independent and learn more, it was time for us as parents to learn some things as well. Mostly, how to let go. And to put our trust in them. It was not an easy process, there was a lot to be done as September is such a hectic board month with the Kick-Off week, the TGMA, organizing new committees and activities but together, parents and new adults we made it through. And when the final moment came, when our paths had to part, we parted with teary eyes but with full trust.

Being a parent was one of the most unexpected but wonderful experiences of our lives and we are glad we got to contribute to the future of the FMF.

Umbral Calculus
First-year Project Mathematics

AUTHOR: **A. HIRSCH**

In elementary school we all get taught $1 + 1 = 2$. Why? Because that is how we define our counting system. One apple plus another apple is two apples. What happens, however, if we rethink this? If we add two piles of sand, we get a bigger, but still singular pile of sand. This would mean $1 + 1 = 1$, a direct conflict to what we are used to [1]. What can we discover when we redefine the fundamental things we assume? What if we redefine logic or even calculus?

This is where Umbral Calculus comes into play. Historically, this is the study of connections, which arose from observing similarities in the derivation of polynomial identities, in which indices were treated like exponents. This means that instead of regular powers x^n, we have $x_n := x(x-1)(x-2)...(x-n+1)$.

The basics

Most of Umbral Calculus is reliant on the definition of the delta operator. It is defined as follows: let $\Delta f(x)$ denote the forward difference of any arbitrary function f and be given by $\Delta f(x) = f(x+1) - f(x)$.

In umbral calculus, the delta operator can be seen as a discrete analog to differentiation. This means that, instead of the derivative, we determine the discrete rate of change; in other words, how much our x changes after each step [2].

For example, let $f(x) = x^3$. The delta operator would be given by:

$$\Delta x^3 = (x+1)^3 - x^3 \iff \Delta x^3 = 3x^2 + 3x + 1$$

Figure 3: Example of Delta Operator
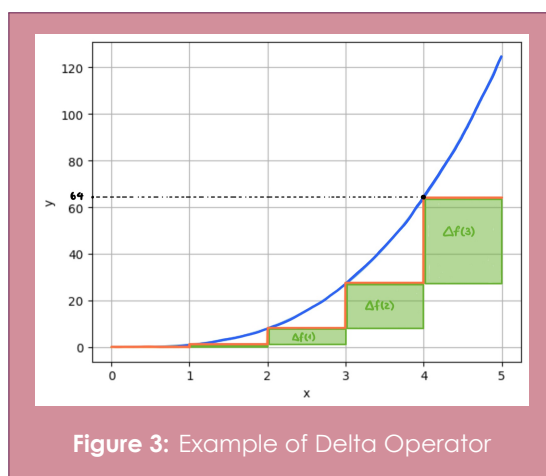
Make difference rules great again!

With this delta operator we can deduce many interesting identities. A lot of the classical differentiation rules we know from continuous Calculus, also find analogues in Umbral Calculus. We can for example derive a similar version of the power rule:

By definition, $\Delta x_n = (x+1)_n - x_n$. We can write:

$$x_n = x(x-1)...(x-n+1) = x_{n-1}(x-n+1)$$
$$(x+1)_n = (x+1)x(x-1)...(x-n+2) = (x+1)x_{n-1}$$
$$\Delta x_n = (x+1)x_{n-1} - (x-n+1)x_{n-1} = n \cdot x_{n-1}$$

Strikingly similar right? We can also find similar derivations for the product and quotient rule.

What in the Fundamental Theorem?

Classical calculus has taught us that integration and differentiation are inverse operations, i.e. $\frac{d}{dx} \int f(x)\,dx = f(x)$ and $\int \frac{df}{dx}(x)\,dx = f(x) + c$ for some $c \in \mathbb{R}$.

In Umbral Calculus, taking the forward difference is the inverse of taking the sum, such that $\Delta \sum f(x) = f(x)$, which follows directly from a theorem we like to call the Fundamental Theorem of Umbral calculus.

Take a function g defined on $[a, b]$ and equidistant points $x_0 < x_1 < x_2 < ... < x_n$ with $x_0 = a$ and $x_n = b$. The sum of Δg over the interval is [3]:

$$\sum_{i=0}^{n-1} \Delta g(x_i) = g(x_n) - g(x_0) = g(b) - g(a).$$

If you're feeling up to it, you can try and derive this identity yourself using the definition!
 Let's see what this theorem means through an example:

Let $f(x) = x^2$ on $[1, 4]$. Then the Fundamental Theorem of Umbral Calculus gives: $\sum_{n=1}^{3} \Delta f(n) = f(4) - f(1) = 15$.
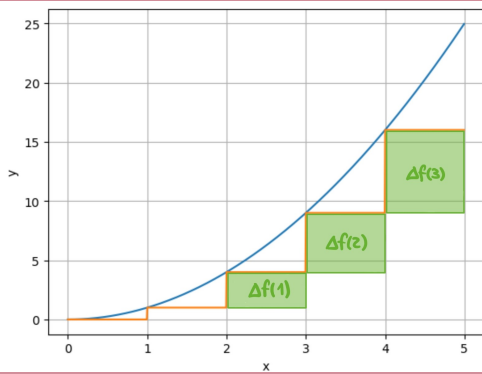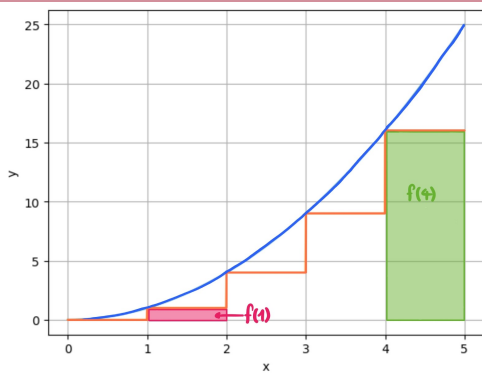
Figure 4: FT Umbral Calculus pt.1

Figure 5: FT Umbral Calculus pt.2

We can see this identity by comparing the sum of the areas in Figure 4 with the area of $f(4)$, deducting $f(1)$ in Figure 5.

Applications

Umbral Calculus has a number of applications in probability theory, financial mathematics and also discrete physics. One noteworthy application is in the Schrödinger equation. It describes the momentum and energy of a wave function, representing the quantum state of a quantum system (e.g. a particle).

In the discrete setting, the Schrödinger difference equation reads:

$$-\frac{1}{2}\sum_{k=1}^{n}\Delta_{x_k x_k}\psi + V(x_1\beta_1,...,x_n\beta_n,t\beta_t)\psi = i\Delta_t\psi$$

where ψ is the wave equation and V marks the potential energy. The discrete Schrödinger equation is equal to its continuous analogue in continuous limit, i.e.,

$$-\frac{1}{2}\sum_{k=1}^{n}\frac{\partial^2}{\partial x_k^2}\psi + V(\vec{x},t)\psi = i\partial_t\psi$$

where

$$\Delta_{x_k x_k} \mapsto \frac{\partial^2}{\partial x_k^2}, \quad \Delta_t \mapsto \partial_t, \quad \beta_i \mapsto 1, \quad \beta_t \mapsto 1.$$

(∂_t represents a partial derivative with respect to t).

The discrete time-dependent Schrödinger equation follows the Lie point algebra of "umbral symmetries", which is isomorphic to that of its continuous limit. Thus, the discrete equation preserves the Lie point symmetry (e.g., translations or rotations) [2].

This may make you wonder, is our universe discrete? The Schrödinger difference equation and the quantization of particle physics are strong arguments supporting the discrete universe theory.

Conclusion

You might be wondering why we should even concern ourselves with Umbral Calculus. Apart from the applications you've seen so far, Umbral Calculus provides a lot of alternative proofs to some theorems we know, for instance the sum of the N first natural numbers.

Additionally, especially on the quantum scale, it can be useful to be able to take the forward difference rather than differentiate, because then it is not a requirement for the function to be differentiable.

References

[1] E. Cheng. "Is Math Real?" In: *Basic Books* (2023). URL: https://profilebooks.com/work/is-maths-real/.

[2] D. Levi, P. Tempesta, and P. Winternitz. "Umbral calculus, difference equations and the discrete Schrödinger equation". In: *Journal of Mathematical Physics* 45 (2004), pp. 4077–4105. URL: https://doi.org/10.1063/1.1780612.

[3] Supware. "The Shadowy World of Umbral Calculus". In: *YouTube* (2022). URL: https://youtu.be/D0EUFP7-P1M?si=oYjiHKyFUYGvh4Y0.

More

If this topic has sparked your interest, check out our full article here. We had a lot of fun exploring this topic as our first-year project, with our little team consisting of Annika Hirsch, Viltė Petrauskaitė, Oliver Pospíšil and You You. Feel free to come up to us and ask questions!

Perio Interview: Marcello Seri
Teacher, Researcher, Podcaster

AUTHOR: **R. MOL**

Marcello Seri is an Italian researcher and teacher who (co-)hosts a podcast about the human side of matheticatics. In this issue of the Periodiek, we get to know him a little better.

What field are you in?

In the broader sense, I'm in what's called mathematical physics, something that some people describe not mathematics, not physics. I work on problems that are related to or whose origin are related to physics, but then they took their own interest as mathematically interesting and sound topics.

I'm working on a few things, but essentially I'm working on topics around Hamiltonian flows, which are certain types of dynamical systems that have some strong symmetries. They relate to conservation of energy in physics, and Imainly look at them from a geometric point of view in what's called sub-Riemannian geometry, which is a generalization of Riemannian geometry, so curved spaces, where you can describe objects that have constraints on their velocity.

The classical example is the bicycle. If I look at how a bicycle moves, I can push it forward and backward, and I can steer the wheel. If I don't allow myself to move the bicycle by sliding, then any other movement has to come from maneuvers by steering the wheel or moving the bicycle back and forth.

And then in these geometries, you want to know what parts of the space you can reach and how you can reach them. And sometimes ask "how can you reach them in an optimal way?"

What interests me even more is studying how these motions are related to the oscillation of waves on the same spaces. So there is something called 'semi-classics' in physics that tells you that for very high energy, non-relativistic physical systems behave like classical systems.

You can generalize this idea in abstract spaces and ask yourself: if I know how something, say a bicycle, moves in the space, then what can I say about how waves oscillates in the same space?

So imagine I have a billiard table. I can study how balls bounce in the billiard table, but I can also fill it with water, shake it a bit and look at how the water wobbles.

And there is a relationship between regular motion that leads to certain types of oscillation and irregular, chaotic motion, that leads to a different type of oscillation. And when you study those properties, you can also infer some information on the geometry of the system, what shape did the table have and what was the volume? What was the length of the of the border of the boundary of this table? So this is the kind of problem that I focus on in this field.

Figure 6: Marcello Seri (right)

When research are you currently working on?

Too many things. I'm working on a project with Dijs Neeling, Diederik Roest and Holger Waalkens on a weird, surprising connection, between classical integrable systems, that's something we work on, and a certain special type of black holes that Diederik was working on. It has been a very good project and opened lots of questions, so we are spending time on that.

I am also working on the continuation of what I did with Federico, my first PhD student, which is about geometric description for dynamical systems that are not conservative.

There is a whole theory that describes systems that have an Hamiltonian component and an entropic component, and with a colleague in Eindhoven we are also trying to figure out how the reduction from a thermodynamic system to this Hamiltonian system can be mathematically understood and made rigorous using these tools. I'd say that There two are each one quarter of my research. And then the remaining the half is on sub-Riemannian geometry and Spectral Theory in sub-Riemannian geometry. This is part of a larger collaboration that also involves Martijn Kluitenberg.

Those are the main three, and then I also have a project with Robbert Scholtens and Rien van de Weygaert astrophysics where we are using Spectral Theory tools to investigate the cosmic microwave background.

Do you prefer teaching or doing research?

Both. I wouldn't like the job with only one of the two. I think they complement each other and also give me a distraction.

So teaching allows me to go deeper in other topics and trying to look for quirks or ideas and just refresh my background. I mean, if I don't teach something, I will forget eventually about most of it.

Research, then, is my way of spacing out and figuring things out, but sometimes I need to be brought back to reality. Also, research can be much more lonely, while teaching is much more social, so I need both.

One of the reasons I came back to university was also because I was missing teaching and the contact with the students. I don't think I would like just doing research.

Do you have any pets?

Yeah, I used to have a dog. He died three years ago now. We are waiting for our kids to grow a bit and perhaps we will get a new one. I really miss him.

What was his name?

Thor, like the thunder god. He was an old English bulldog, so very solid dog. I think the name was very appropriate, very stiff, very kind. He liked to just sleep, run five minutes and sleep again.

There are our neighbour's cats that very often come to visit us. When our neighbor is away, they come to our garden. And we had two shrimps and two fish. But our real pet was Thor. I'm not yet ready to replace him. Even though he passed away three years ago. He traveled with us. We got him in Germany and then he went with us to London and then moved here with us.

"He liked to just sleep, run five minutes and sleep again"

What is your favourite equation?

$A = A$. Just the equality, simple identity as it is. This popped up when we were studying philosophy in secondary school and our teacher was always talking about the importance of the equivalence relation and this identity in certain philosophies, by now I've forgotten all the philosophical context, but somehow I remained always impressed. It just emphasizes the fact that with an equation, you're just saying that something is equal to something else, whatever they are, and so, it sounds dumb, but if I think of an equation, this is the first one that comes to mind.

What is your favourite XKCD comic?

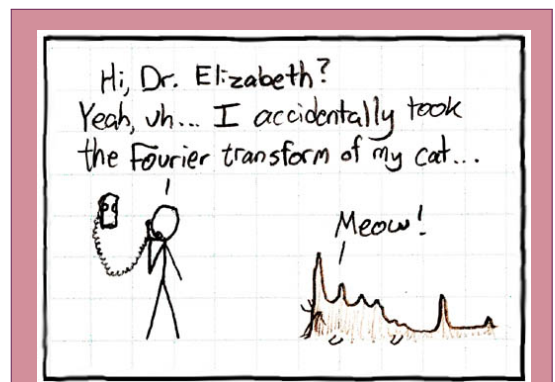The Fourier transform of a cat (seen below).

Figure 7: Marcello's favourite XKCD comic: Fourier

How did you end up as an academic in Groningen?
I had a very interesting experience in high school with a lecturer from our university in Camerino coming to talk about the mathematics of gravitational lenses, and at that time I knew I wanted to study something scientific. After that lecture I knew I wanted to do mathematics. At the university I really liked how different was the mathematics you do at the university and how stimulating it was. And there I decided that if I was able to, I would like to have a career in academia, and then from there I bounced. I went to a master in Bologna and then I did my PhD in Bologna and Erlangen, but I spent most of my time in Erlangen and then from there I postdoc at UCL in London.

I pretty much invested most of my time trying to get an academic career, which is also requiring some amount of luck, because you need to find the right position, opening at the right time and having the right network and the right history so that you can sell yourself for that position.

And in fact, when we had our first kid, I left university and I went to work for a company for two years. After that, mostly due to Brexit and how the atmosphere was changing in England, I restarted looking at jobs in Europe and the advertisement in Groningen appeared and it was basically fitting my background. I had worked on some topics that Holger also had worked on. I didn't know him at the time, but I had worked on some related topics, so I also have some indirect connection to the place in terms of being able to fit in and have related research. Having a common background, helped me also to start talking to people here much faster.

You mentioned you have kids
Yes, I have two kids and my office is covered with their drawings and sometimes they even notice if I haven't changed them or haven't put up something that they gave me recently. You probably have not seen the pile of drawing that is next to the one that are hanging on the walls. We have a son that is seven years old and a daughter that is almost five. They both go to a Dutch school.

Are you raising them bilingual?
Yeah, we speak Italian at home, and we speak Dutch at school, and then when we have guests we might speak English and some TV shows that we watch are in English, but mostly Italian and Dutch.

Who is a colleague that you really admire?
There are so many. It's hard to choose because there are really a large number of them. I've learned a lot from them, but if I have to pick one at this moment, I would say Tamás (Görbe). He puts really a lot of energy and enthusiasm into what he does, most people put a lot of energy and enthusiasm in what they do, but he has been pushing for changes in teaching in the way we deal with the students, in the way we select the TAs, and even in the way we organize the courses.

He makes us talk about teaching and I really admire not just how much energy he put into that, but also how much he has been able to shake us and move us from what we were doing usually to embrace these changes and embrace attempting new things and at least discussing them and to start thinking about them.
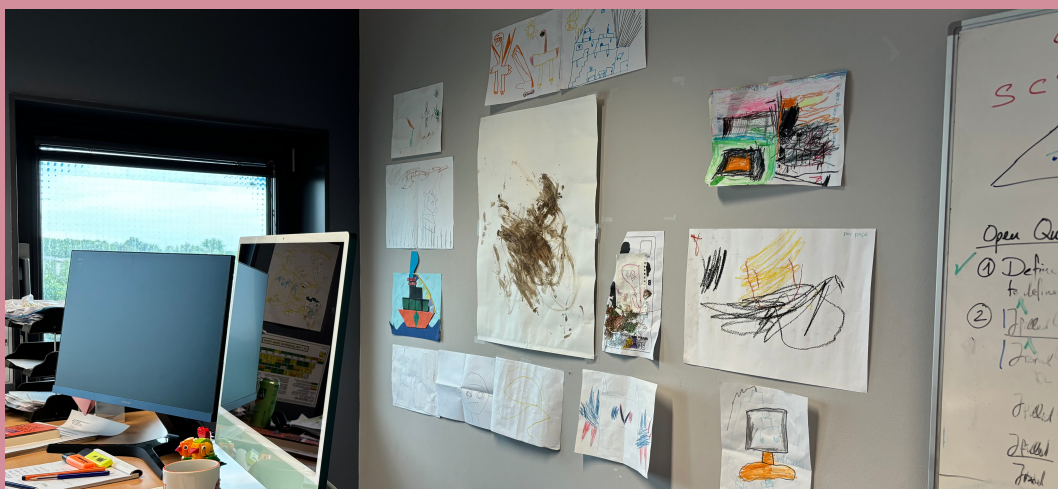

Figure 8: The drawings in Marcello's office

What is your favorite course currently that you teach or that you have taught?

I am torn between Hamiltonian Mechanics and Spectral Theory, because these are two courses that are really close to the things I work on and that I like, I don't just enjoy teaching them, but it's an opportunity to start exploring some other corner of the field that I'm not too knowledgeable about. So they are always full of surprises, and also in both cases, the students have a scope to explore on their own and usually new things come out of it.

Do you play any video games?

Yes, so my favorite ever video game is Stardew Valley. I really love it. I stopped playing it because otherwise I don't do any work. I also like strategic ones like StarCraft and and Warcraft. Before it became an online thing, I played those a lot. I also played a lot of Final Fantasy. Also Zelda, I played many in the sage, and I like Super Mario and I finished many of those as well. I also like Mario Kart. Every now and then we play just to kill zombies, with no specific game, just zombie apocalyptic games where you go around and just shoot the zombies.

Oh and Diablo, I played Diablo II and III a lot as well, I have not played the fourth (between the interview and publishing, Diablo IV went on sale, so now he plays this as well). I have to play in the evening, but then I'm tired. Our son likes Mario Smash Brothers a lot but that one doesn't click with me, it's just too much noise. If I want noise, I play Broforce. It's a fantastic, horrible game to play with friends. You just destroy everything and move on. It has characters that are like mock-up of famous baddies or characters from movies, so you have something like Robocop, something like Predator, things like that. That's a really fun, stupid game.

There are also some games that I like but have not played recently. I finished all the Monkey Island, Sam & Max, all these games where you have to click around to solve riddles. Oh, and Broken Sword 1, 2, and 3.

Do you have any other hobbies?

I like to play music, with the guitar mostly, but I've not done it regularly for over a decade so I got very bad at it and then I get upset when I play because it doesn't work the way it used to. But I do like that. I like climbing and for the same reason, I don't climb that much now. Also, my knees are not that good, so I should train more. I used to do it in the mountains, but now I almost don't do it. Very rarely I go to the gym to do it a bit, but very rarely.

I like reading and I like growing stuff. I've grown my own sourdough yeast and then experimented growing a few other things. We had a shiitake kit at home to grow the shiitakes and then make risotto out of them. We tried to grow oyster mushoorns but it didn't work. I'm not yet sure why. We got some. They were very weird so we didn't eat them. We have grown a lot of plants. When we were still in England, I had a garden with tomatoes and salads. Now we have a big bush of chilies and with this weather it's making really a lot of them. And we have an apple tree that started from a seed and now it's like one meter high.

Also, I like baking, like making bread and making pizza. I find it relaxing Playing with the dough and cooking something out of it.

"I stopped playing it because otherwise I don't do any work"

Which two colleagues, students or PhD students would you want by your side if you were stranded on an island?

I think we should start going out more with the colleagues so that I can make an informed choice. Okay, this is a really hard question. I don't know, thinking of having a laugh and playing board games. Probably I would say Diederik Roest and Oliver Lorscheid. But there are plenty more PhDs, students, and colleagues that I would be happy to be there with.

What did you have for breakfast today?

Today was boring. I had a cappuccino and biscuits with Nutella or chocolate spread on top.

What kind of music do you listen to?

It's varied, but I like metal, especially when it's something like power metal or more melodic types of metal. I like heavy metal, hard rock and more classical rock, blues, and jazz. So that is what I mainly listen to. Sometimes I listen to classical music, if I need to focus, but mostly rock and metal.

Do you have any favourite bands?

If I have to pick two, I would probably say Iron Maiden and Dragonforce. I never seem to get bored of them.

What is something that you are proud of?

I am proud of the work we are doing to be more conscious about setting boundaries between life and work and balance it more, and also bringing this to the University and try to participate in the discussion and

influence the decision so that this becomes a more broad change of culture. I also say this to our PhD students. I always say take the holidays. Weekends are off. If you want to work at night, it means that you don't work at day. You need to have your boundaries set and learn it now, because otherwise you don't learn it until it's too late.

You host and produce a podcast called '*It's Not Just Numbers*' together with Marit van Straaten, what can you tell us about that?
It is not too different from this interview. Part of it is to shorten the gap between staff and students and to show a bit more what we are doing, aside from the research. We show the people, what motivates them, but also what goes on in their day-to-day life as a mathematician.

So all the various aspects of the job that you don't see as students and also the various aspects that perhaps we give a false impression about, like what goes on in preparing a course, in preparing the homeworks and the exam, what is in our mind, what kind of strategies we take when we have to come up with a course or with a curriculum, how do we study mathematics, things like that, how we try to communicate mathematics, and so on.

Figure 9: The logo of Marcello's podcast

One half of it is to get to know the people, how they became mathematicians, what motivates them, and also to show the huge variety of different histories and different backgrounds and different interests that we have. The other half is about what it is like being a mathematician. The whole idea came from a discussion we had during the pandemic in the break of Analysis of Manifolds.

Some students were talking about how long it takes to do the homeworks and they don't know the answers by heart and you have to work on them and how it does not come as easy for them as it comes up for us. That was kind of shocking because for each homework sheet, the first time we prepare it, it can easily take two days (if not more!) because you don't know the answer, you have to solve it yourself. Sometimes you have to adjust them because they are too simple or too hard and you didn't realize they were. Sometimes you need to find a way to formulate them clearly, they might not be to the point.

So it does take a lot of time. We make lots of mistakes when we prepare the assignment and the solution. So there is work, a lot of work in fact, behind the curtains until this is ready. And of course, after five, six years of teaching the same course, it becomes much more natural. But the first couple of years, besides having more experience, we are not that far away from being students ourselves. And I wanted to find a way to show these parts of the job to the students.

> *"We show the people, what motivates them, but also what goes on in their day-to-day life as a mathematician"*

Who has been a really memorable guest on the podcast?
I think so far they have been all memorable in different ways, so I really cannot pick one. And I like that. That is because they are all very different and since one of the objectives is also addressing some stereotypes of mathematics and mathematicians, I think it's nice to see the differences and the wide variety of people on the podcast.

Where can people listen to your podcast?
You can listen to it on the apps your normally use like Spotify, Apple Podcasts, Amazon, and more. Season 2 is going to start soon with Anna de Bruijn as co-host, and this time we will also have guests from outside of Groningen!

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Beginners only: How a fresh grad started their engineering career at ASML

Mechantronics engineer Naveen shares how he landed at ASML fresh out of college and his exciting career journey, working at the heart of tech innovation

Working for a semiconductor industry leader can seem daunting, especially for a new graduate. Is my degree suitable? Will the work environment be good? Will it help me develop my career? The stress is real for fresh graduates and at ASML we know that all too well. It's the reason we host multiple student events every year, offer scholarships and work-study programs, next to masterclasses and opportunities for young professionals. Our colleague Naveen Venugopalan, a Design Engineer, was in the same position a few years ago, and he explains exactly how he figured it all out, with support from ASML.

Discovering ASML

"After completing my bachelor's in Electrical & Electronics engineering in India I chose to pursue my master's in Systems & Control at the Eindhoven University of Technology (TU/e). During the first week of my masters, we had the chance to visit different companies as part of the orientation and I chose ASML."

Naveen experienced ASML first-hand and was impressed by the complicated technology and innovative lithography machines. "After the visit, I was floored and certain that I wanted to work here someday. To me, ASML seemed like the company that could make use of the skills I've obtained through my master's and help me reach my maximum potential."

"Beyond being one of the most technologically advanced companies in the world, ASML uses the latest technology in all fields, especially in Systems & Control."

After seeing a job opening at ASML through LinkedIn, Naveen decided to take his shot and apply. "It was for a Technical Graduate Program in Mechatronics, meant for new graduates."

After a couple of engaging interviews, as Naveen describes them, he was offered to start directly as a Design Engineer, instead of going through the graduate program.

Making an impact

ASML is a large organization with over 40.000 colleagues globally. To ensure harmonious working ASML's teams and departments work together to form an innovation hub, Naveen says.

"Depending on the group or project, I experienced either a well-established mature setup or a rapid innovation ecosystem with a bit of an ad-hoc workstyle. It is the same exciting dynamic environment you see at start-ups, that I see in the teams I work with.

At ASML, you're never bored, because "the machines we make here work with nanometer accuracy and that intrigues me to this day. Working on multiple projects where you communicate with different teams and stakeholders allows you to gain knowledge in many different domains. Though you are divided into several groups and teams, you are certainly connected at work towards a common goal."

Working and developing

Naveen also explains that ASML's onboarding program also greatly helped him navigate his first months as a working professional. "You are assigned a buddy for the first 3 months, to help you get acquainted with the team and its way of working."

"Moreover, both your team and your managers support you in making an impact at work. Even when you're new, you're not going to sit idly in your first months. You're assigned projects, you attend meetings, and you're exposed to all kinds of tech challenges, but are also always welcome to speak up and offer input."

He explains that there is also room for your personal development. "Generally, you have a course list meant to improve your soft and technical skills. Moreover, along with your manager you'll often set new career goals and even create a tailored course list that may help you advance your career."

"There are also internal mobility events and career opportunities within ASML. With support from my managers, I got the opportunity to transfer to a new team. These transfers stimulate communication and cooperation among teams and are a nice way to exchange knowledge."

Feeling at home

Being an expat and working for a big company has it's struggles, but Naveen says that ASML has offered him a friendly and easy-going environment. "Everyone is approachable, and willing to share information. Knowledge sharing within and across teams is very appreciated."

"We all stick to our values of Challenge, Collaborate and Care. You're given space to grow and shine. Even if you're not very well connected to a topic or a discussion, your opinions are equally valued. Inclusion is a core objective at ASML and speaking up is promoted. Whether it's a random idea during a group brainstorm or a technical discussion or a safety and well-being concern, you're always acknowledged and respected when you speak up," Naveen concludes.

ASML

ASML is a high-tech company, headquartered in the Netherlands. We manufacture the complex lithography machines that chipmakers use to produce integrated circuits, or computer chips. In almost 40 years, we have grown from a small start-up into a multinational company with over 60 locations in 16 countries and regions, more than 40,000 people of 143 nationalities, and annual net sales of €21.2 billion in 2023.

Behind ASML's innovations are engineers who think ahead. Our researchers, engineers, and manufacturing specialists, as well as our high-tech hardware and software, all work at the edge of what's possible. That's why our customers include all the world's leading chipmakers.

Because ASML spends €3.3 billion per year on R&D, our teams have the freedom, support, and resources to experiment, test and push the boundaries of technology. They work in close-knit, multidisciplinary teams, listening to and learning from each other.

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

Speak Dutch or go home?
FSE student sentiment on the current political climate of tertiary education

AUTHORS: **A. SILVANS, L. DIJKSHOORN, T. DE NOOIJER, E.K. HENDLA, F. BERGWERFF, R. MORAR, G. MANU-MARIN, M. BENESCU, O.M. FLOREA, A.J. MOHSENI, D.C. BUNEA, M. GRZEGORCZYK**

Political attempts to 'de-internationalise' the Dutch university education have led to many discussions. In the Honour's college course: '*Practical Statistical Hypothesis Testing*' of the academic year 2023/2024, we used Google Forms to design a student questionnaire. We distributed the questionnaire at the University of Groningen to ask students to share their background, their sentiments, and their opinions on switching university education in the Netherlands from English to Dutch. In this paper we report on trends that we discovered in the responses.

Background

The internationalisation of university education in the Netherlands is a double–edged sword that has led to many discussions. Opinions vary greatly between political parties, students, and universities. Universities argue that there are numerous benefits for science, education, society, and economy (1,2). However, these opinions may be biased, because international students bring '*big money*' (3). Some students like the education in English, while others argue the high pressure on the housing system is mostly the fault of internationals (4).

However: '*The numbers don't lie*'. The statistics of the CBS (the Dutch Central Statistics Office) show that the percentage of first-year international students in Dutch universities has increased from approximately 10% to 35% since 2005. This increase is even higher if universities of applied sciences, like the Hanze Hogeschool in Groningen, are left out. Then the percentage of international students in study year 2021/2022 increased to almost 50% (5). The increase of international students in the Netherlands is said to be caused among other reasons by the Brexit referendum in 2016 in the UK which was finalised in 2020. This has resulted in a 40% decline in undergraduate student applications from the EU in the UK in the first study year after Brexit in 2021/2022. This decline has continued in the college year 2022/2023 in which there was a further 24% drop in applicants.

The sudden increase in international students has sparked political debate on the potential reduction of the number of international students. This debate has already led to the preparation of a bill with the name: '*Internationalisering in balans*'.

This bill will use a rule set to check if a study that contains more than a third of its courses in a different language than Dutch is qualified to be so. This bill is still in its design stage but will most likely be executed and possibly be more rigorous in light of the recent elections.

The biggest winner of the election – the party PVV – has for example mentioned in their program that they want to severely restrict international study migration by making the teaching language in all BSc programs in Dutch, and restricting the number of international students in the MSc programs (6). These statements are supported in a less firm manner by their possibly future coalition partners: VVD, BBB and NSC. However, there are differences between how these three parties want to lower the number of international students. The BBB wants to change how universities are funded (9) whilst the NSC and VVD want to make BSc programs predominantly Dutch taught with some exceptions (7,8). Both BBB and NSC want to limit the number of foreign students by implementing a maximum number of foreign students allowed in each university city. This would be determined by, among other things, the availability of housing in each city (7,9).

On the other hand, the biggest opposition party, Groenlinks-PvdA, has only mentioned it wanting universities to better support their choice for an English-taught program and better supervision on these choices (10). The opposition party and others, like the party D66 (11), therefore have considerably less severe plans about limiting the number of foreign students. At this point, it seems that if the four biggest parties would collaborate in the future they would not have a majority in the senate (in Dutch: '*Eerste Kamer*') (12).

This would prevent big decisions from getting through, so the chances of all programs becoming Dutch taught are small. Teaching language goes hand in hand with internationalisation. There are clearly many pros and cons to internationalisation. In this report we hope to provide some insights in the opinions and preferences of students at the Faculty of Science and Engineering (FSE) of the University of Groningen (UG).

The Google questionnaire

For gathering relevant data for this project we designed a Google Forms questionnaire with 24 questions, and it was distributed via WhatsApp channels and university emailing lists among students of the University of Groningen. The questionnaire received submissions for roughly two weeks between February 26 and March 13, 2024. There were 920 responses with complete data. Our intention was to reach out to students across all eleven faculties. Students from 10 faculties contributed, and we observed a predominant participation (88.9%) from the Faculty of Science and Engineering (FSE). We therefore decided to focus our attention on FSE students. Henceforth, all trends that we report here refer to FSE students and might not be representative for students of other faculties. Our Google Form was structured into two sections. The initial segment gathered personal information. In particular, we asked the participants about their nationalities (country of origin). We only offered three response options:

- The Netherlands (NL)

- The EU (without NL)

- Outside of the EU (non EU)

The 2nd section delved into more specific topics, like the topic of '*de-internationalization*'. Here, we asked questions about future plans to stay or leave the Netherlands, preferred study language, opinions on the quality of education, and how this would be affected by switching to Dutch.

Figure 10: 90% of respondents were from FSE
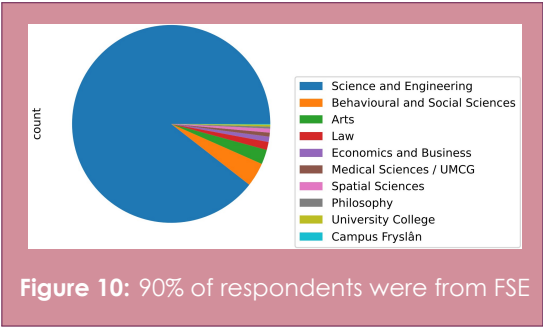
Abbrev.	Names
AM	Applied Mathematics
AP	Applied Physics
AI	Artificial Intelligence
A	Astronomy
AQU	Astronomy: Quantum Universe
BCN	Behavioral & Cognitive Neuro Sciences
B	Biology
BmedE	Biomedical Engineering
BmedS	Biomedical Sciences
BmolS	Biomolecular Sciences
CE	Chemical Engineering
C	Chemistry
CCS	Computational Cognitive Sciences
CS	Computing Science
EE	Ecology and Evolution
EES	Energy & Environmental Sciences
IEM	Industrial Engineering & Management
LST	Life Science and Technology
MB	Marine Biology
M	Mathematics
M&P	Mathematics and Physics (double)
ME	Mechanical Engineering
MPS	Medical Pharmaceutical Sciences
Nan	Nanoscience
Pharm	Pharmacy
Phys	Physics
SEC	Science, Education & Communication

Table 1: Degree name abbreviations.

Our assumption.

A critical question is whether the 920 respondents are representative for FSE students. Only if this is the case, we can draw reliable conclusions from the results. Unfortunately, we have to admit that we did not properly check this. However, we trust that the student distribution is not in significant mismatch to the true student distribution of FSE. Nevertheless, the trends that we will report below might be biased by an over-representation of particular FSE student groups (cf. Fig. 11).

Who responded?

The distribution of the numbers of responses among faculties is shown in the pie chart in Fig. 10. When focusing on the FSE students we find that there are 408 Dutch nationals, 345 European (non-NL) nationals, and 70 students from non-EU countries. Fig. 11 shows the student distribution across 27 degree programs at FSE; we refer to Table 1 for the abbreviations of the names. From Fig. 11 it can be seen that significantly more BSc students than MSc students responded. Most responses came from the degree programs: Biology (B), Computer Science (CS), and Physics (P). Close behind followed Artificial Intelligence (AI) and Chemistry (C).
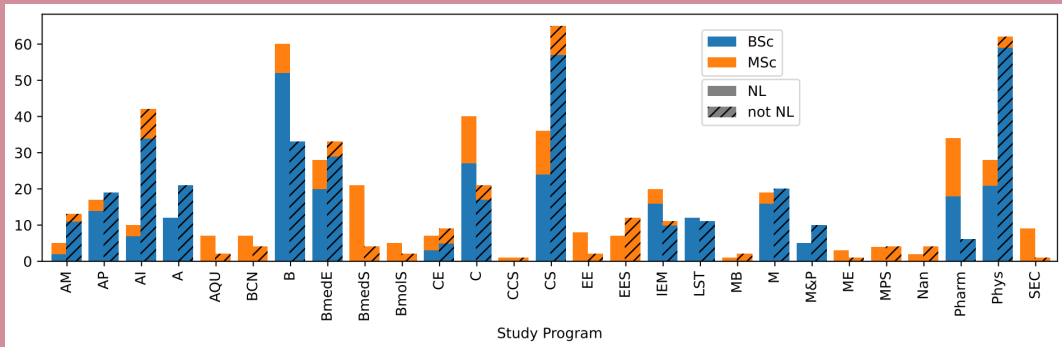
Figure 11: Students by program and nationality; Dutch (NL) vs. international (not NL).

Overall, it seems that the fraction of international students is significantly higher in the BSc programs and that the fractions of international students vary substantially across the degree programs. Biology (B) and Chemistry (C) seem to have large proportions of Dutch students, while Computer Science (CS), Physics (P), and Artificial Intelligence (AI) have large proportions of international students.
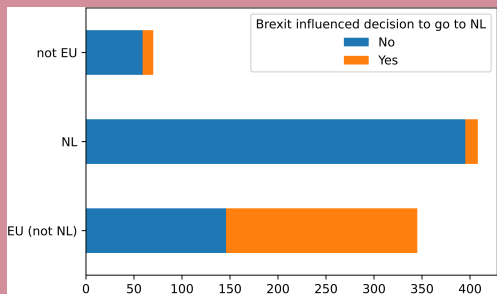

Figure 12: Brexit effect on the no. of students.

Fig. 12 shows to which extents Brexit affected the decision of students to study in the Netherlands. Not unexpectedly, in particular the group of EU (non NL) students was affected by Brexit. Apparently, more than 50% of the EU (non NL) students originally had the intention to study in the UK.

Who is able to speak Dutch?

Fig. 13 gives an impression of the Dutch language proficiency among Dutch and international students. As expected, almost all Dutch students (402 out of 408) can speak Dutch fluently. Likewise, most international students (723 out of 753) are not fluent in Dutch.
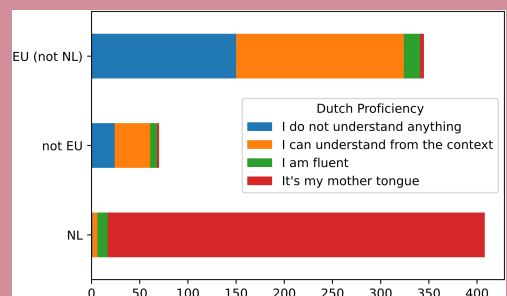

Figure 13: Dutch language proficiency by nationality; NL vs. not EU vs. EU (not NL).

Who would prefer education in Dutch?

Non-Dutch speakers are very unlikely to prefer being educated in Dutch. But it is not clear whether Dutch native speakers would prefer this. An advantage would be that that they are likely to be more proficient in their mother tongue. However, there are also potential advantages of English education. First, it can attract internationally recognized lecturers/researchers. Second, it will improve the English proficiency of the students what might turn out to be advantageous when joining the job market.

Our first question is therefore which education language the Dutch students prefer? Fig. 14 focuses on the Dutch students and shows their preferred study language and the impact they expect from the language. There is a histogram for each of five study language categories (ranging from fully English to fully Dutch) and the five bars of each histogram refer to the expected impact. The clear majority of Dutch students prefers an English (or mostly English) taught study program and would expect a decrease in quality in case of a switch to Dutch.

However, we do not want to leave unmentioned that there is also a small fraction of Dutch students who would prefer being educated in Dutch (or mostly in Dutch) and would expect an improvement from switching to Dutch. In particular, the students studying in a predominantly Dutch taught degree program do expect a negative effect from switching to English.
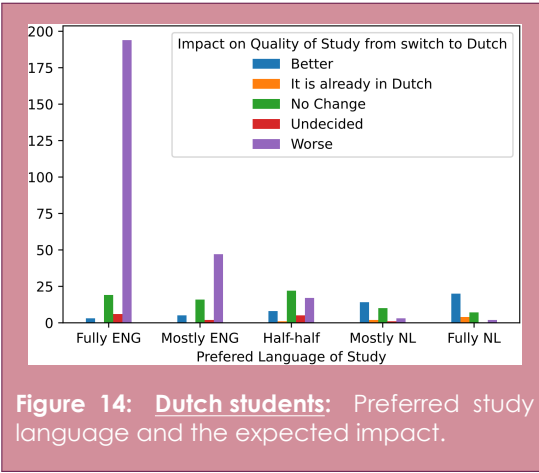

Figure 14: <u>Dutch students</u>: Preferred study language and the expected impact.

Who considers staying in the Netherlands?

An argument for the '*de-internationalisation*' of the university education is that the majority international students will leave the Netherlands after graduation. To shed some light onto whether this is true, our questionnaire also featured the question, whether students consider staying in the Netherlands? Here, our focus is on the international students, and we distinguish between EU (non NL) and non-EU internationals. Fig. 15 shows the fractions of international students that consider staying in the Netherlands and the group-specific fractions of students that would still have chosen a Dutch university if learning Dutch till language level A2 would have been required. The figure has two panels for non-EU and EU (non NL) internationals and contains two pieces of information: the three histograms on the horizontal axis refer to future plans to leave or stay in the Netherlands, and the five histogram bar colors reflect the willingness to reach Dutch language level A2 for studying. First of all, we see that among both groups the majority is undecided about staying in the Netherlands. Among those with intention the EU internationals seem more likely to leave than the non-EU internationals. Not surprisingly, international students who consider staying would less mind the language requirement. A rather clear finding is that around half of all international students were (probably) not studying at Dutch universities if there would have been an A2 language requirement.
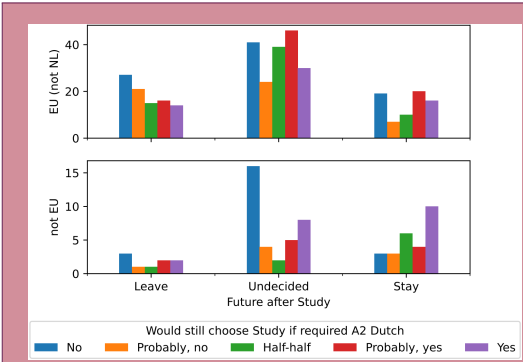

Figure 15: <u>International students</u>: Future plans and opinion on language requirement.

Do Dutch and international students differ?

In the questionnaire we also asked for the average GPA ('*grade point average*'), the average alcohol consumption [units per week][1], and the average amount of self-studying [hours per week][2]. The boxplots shown in Figure 16 show the group-specific distributions.

Although we do not see any substantial differences, we would like to mention the following trends: First, the median GPA is around 7.5 and the performance of the group of EU (not NL) students is slightly above average. Second, the NL students seem to consume a bit more alcohol than the international students. Third, the median of the number of self-study hours is 20 hours and Dutch students seem to self-study a little bit less.
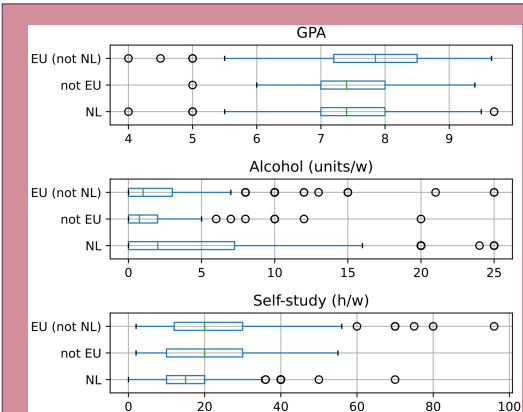

Figure 16: Dutch vs. international students.

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[1]We defined a unit of alcohol to be the equivalent of a bottle of beer, a glass of wine, or a shot of strong spirits.
[2]Outside university teaching sessions.

What do we conclude?

Under the assumption that the 920 respondents are representative for FSE students, we conclude:

- Brexit has indeed increased the number of EU internationals, and the proportions of international students significantly differs among the FSE degree programs.

- The clear majority of international students has only limited Dutch language proficiency.

- The clear majority of Dutch students would prefer staying with the English education.

- The majority of international students is undecided about staying in the Netherlands. A Dutch language requirement (level A2) might decrease the number of international students by around 50%.

All authors share the concern that political interventions might have very negative effects on the quality of university education in the Netherlands.

References

(1) Internationalisering. Tilburg University.
https://www.tilburguniversity.edu/
nl/samenwerken/internationalisering#:
~:text=Internationalisering%20is%
20van%20groot%20belang,voldoende%
20talent%20voor%20de%20arbeidsmarkt.

(2) Hoe het Nederlandse hoger onderwijs populair werd bij internationals, DUB.
https://dub.uu.nl/nl/achtergrond/
hoe-het-nederlandse-hoger-onderwijs-
populair-werd-bij-internationals

(3) Internationalisering: de feiten en meningen op een rij, U-Today.
https://www.utoday.nl/news/67704/
internationalisering-figures-pros
-and-cons

(4) Van Elven, M., Nederlanders en internationals: twee aparte werelden? DUB.
https://dub.uu.nl/nl/achtergrond/
nederlanders-en-internationals-twee-
aparte-werelden

(5) 40 procent eerstejaars universiteit is internationale student, CBS.
https://www.cbs.nl/nl-nl/nieuws/
2022/11/40-procent-eerstejaars-
universiteit-is-internationale-student

(6) NEDERLANDERS WEER OP 1. (2022), PVV Verkiezingsprogramma.
https://www.pvv.nl/images/2023/
PVV-Verkiezingsprogramma-2023.pdf

(7) Omtzigt, P. (2023). Tijd voor herstel Verkiezingsprogramma 2023. Nieuw Sociaal Contract.
https://storage.googleapis.com/
groep-pieter-website/media/NSC_
verkiezingsprogramma_2023.pdf

(8) VVD. (2023). Verkiezingsprogramma VVD, 2023.
https://www.vvd.nl/wp-content/
uploads/2023/10/Verkiezingsprogramma-
VVD-2023-2027-1.pdf

(9) BBB. Van Vertrouwenscrisis naar Noaberstaat. Visie en Verkiezingsprogramma 2023-2027.
https://boerburgerbeweging.nl/
wp-content/uploads/2023/10/BBB_
VERKIEZINGSPROGRAMMA_NOV2023_Corr5.
pdf

(10) Groenlinks-PvdA Verkiezingsprgramma, 2023.
https://groenlinkspvda.nl/wp-content/
uploads/2023/11/VKP-DEF-1-11-23.pdf

(11) D66. Nieuwe energie voor Nederland, D66, 2023.
https://d66.nl/wp-content/uploads/
2023/11/2023_20nov_DEF_D66_VKP2023_
2023-2027.pdf

(12) Braak, Bert van den. Begaanbare wegen?
https://www.parlement.com/id/
vm8mlwrpohms/begaanbare_wegen#:
~:text=De%20combinatie%20PVV%2C%
20VVD%2C%20NSC,in%20de%20Eerste%
20Kamer%20hebben

KBE '24 Viena & Trieste
The story of Boltzmann

AUTHORS: **A. BRANUT, D. IONESCU, Y. YETKIN**

Boltzmann started taking shape in the summer of 2023, when four members got together and decided that the FMF needs more travelling in her life. As I am writing this, it's already been a year since the Boltzmann adventure started - for the committee that is. Since then, KBE Boltzmann happened, memories were created, new academic horizons were discovered and the passion for science was rekindled.

What is KBE you might be wondering? It is nothing but the study trip abroad that the FMF organises to various destinations in Europe. One of the principal goals of the excursion is to give students the opportunity to get familiar with the state of research in other countries by visiting universities and research institutes. So this is what we did! In case you have missed the great news, this April we travelled all the way to Vienna and Trieste.

In a group of 26 lucky wanderers, we set off on a fortunate, God blessed day of 20th of April. We boarded the infamous NS, and off we went. Much to everyone's delight, we then transferred to a Nighttrain, which sealed our faith for the night. Everyone managed to get the best sleep of their life and there were no issues encountered whatsoever (in reality there were very poor sleeping conditions and on the train we were greeted by a tipsy family of angry Austrians who did not understand the concept of carriage numbers).

"Extending the seats in order to turn the cabin into a giant shared bed sounded great in practice but in reality amounted to around 10 hours of sleep... shared between 5 people." - Yoana Savova

However, we reckon that it was all worth it for what was lying ahead of us. The highlight of the following day was the Natural History Museum, which we can confirm definitely has something for all tastes! As a wise Day Commissioner once said as a piece of wisdom for travellers far and wide:

"If there is a Natural History Museum, go to the Natural History Museum!"

"The first few days were especially hectic"

If you're wondering how a day on the trip looked like, you have to start with a very early wake up and committee sometimes knocking on your doors and continue with an even more rushed breakfast. After all, we had to seize the day! The first few days were especially hectic. The mornings and afternoons were mainly dedicated to research institutes, with some free time sprinkled in between.

"The amount of pretty rocks in one place - a dream come true!" - Yoana Savova

The academic visits started with probability and logic talks at the University of Vienna. Can we make sense of the random and of the unordered? - is what these talks were about. In our time there, we got to visit the Academy of Austrian Sciences, which even put up signs with directions especially for us and gave us the warmest welcome! At the outskirts of Vienna, the Institute of Science and Technology Austria was waiting to tell us all about the physics of squishy stuff, thermodynamics of quantum materials and their very interesting labs! We heard all kinds of interesting stories about why these people decided to pursue this path, such as wanting to explore a gap in our knowledge that she heard about during her time as a student.

Physics & Mathematics
study association visit,
Groningen University
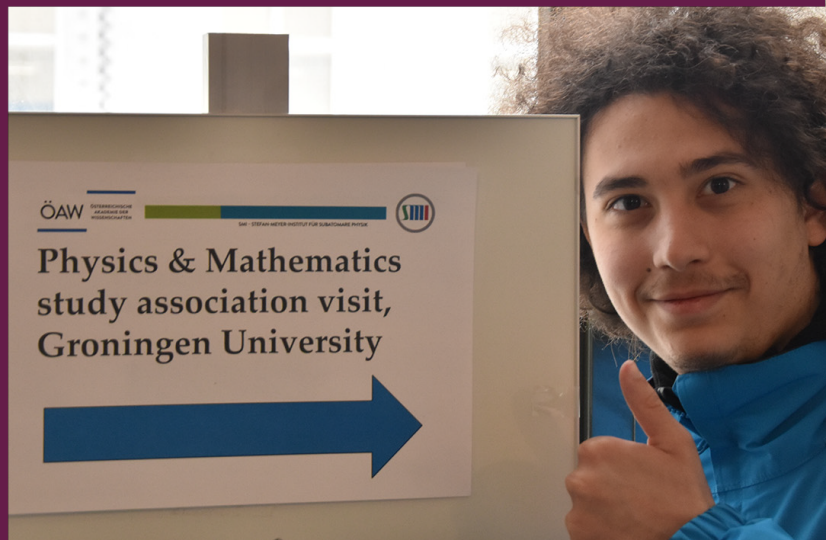
In Vienna, the subway was our best friend. Once we had to use public transport, we were quickly splitting into buddy groups and walkie talkies were becoming our main means of communication, which was very helpful and also super fun to have (at least for us, if not for the ones around us). After a lot of running around and a must-have visit to Schönbrunn, our first time in Vienna was rounded off by a delicious group dinner where we were treated with a round of limoncello shots on the house! What a smooth transition to our next destination!

"All these stories reminded me about what I love most about Physics and science as a whole. It is a chance to measure the unmeasurable, explore the unexplored, but also do stuff just for the sake of it."
- Luca Bachiri

After discovering the cultural and scientific cluster in Vienna, it was time to embark on a 6 hours (almost) journey to our second destination, Trieste. Upon a snowy drive and a well deserved KFC break, we found ourselves at SISSA, The International School For Advanced Studies. The view from the lecture room was breathtaking! The presented Gravitational waves were propagating, together with our sight, through the big window towards the Adriatic sea.

"All of us had fun playing with 3D-printed puzzles at the SciFabLab "

At SISSA, we also discovered their PhD programme opportunities and we had the chance to ask the students questions about their experience. Their doctorate degree includes a full year of courses, before choosing the thesis topic. Isn't that cool? After engaging in future study prospects, the group checked-in at a hostel located in the city centre and, at the recommendation of one of the PhD students, had dinner at an Italian restaurant. The food was incredible, and, very shockingly, extremely cheap!

"This dinner was probably the cheapest until now with people paying far below €20 for starter, main dish and drinks." - *JP Espírito Santo*

ICTP or the Abdus Salam Centre for Theoretical Physics, marked the end of our academic visits. We were fascinated by the story of Abdus Salam and his Nobel Prize (that we got the chance to see and photograph), by his contributions to the scientific community, and by the collection of Physics and Mathematics books offered by their library. After that, all of us had fun playing with 3D-printed puzzles at the SciFabLab.

"You will have to hear the stories firsthand"

On our last full day in Italy, we took a descent in the Grotta Gigante cave, which is one of the largest show caves in the world!!! The day continued with even more stunning nature and scenic sights, with a trip to a water spring and a stroll near the sea. With the memory of delicious food and beautiful Italian castles in our hearts, we knew this is all slowly drawing to an end.

"At the end of the day, we watched the sun set over the Adriatic Sea, and in a way, this moment also marked the end of the FMF KBE trip 2024. What an adventure it has been!"- *Jelger Bijma*

A car ride away, Vienna was waiting for us once again, for that was our point of departure back to the Netherlands, which turned out to be quite eventful. But for that, you will have to hear the stories firsthand from someone who was there to live it.

Which Periodiek member are you?
Take the quiz!

AUTHOR: **I. BALINT**

We are sure everyone wonders which Periodiek member they are most alike, so we have devised a tool for those inquisitive. Find out which Periodiek member you would enjoy being stuck in traffic with by answering the questions below!

Favorite shade of green?

Emerald green
Forest green
Pine green
Yellow

Go-to restaurant in the city?

De Pastafabriek
Fat Phills
Otacos
Poke spot

Favorite type of weather?

Rainy while inside
Stormy
Snowy
Sunny but not too hot

What object would you want to have with you if stranded on an island?

Boat
Book
M16 Rifle
Sharp knife

What is your favorite beer?

Desperados
Cherry chouffe
Kasteel Rouge
Tripel Karmeliet

Favorite non-alcoholic drink?

Aloe vera juice
Iced oat latte
Smoothie
Water

What superpower would you like to have?

Lightning wielding
Mind reading
Telekinesis
Time travel

Favorite scent?

Bourbon vanilla
Citrus
Freshly cut grass
Hyacinth

Go-to sauce for fries?

Mayonnaise
Mustard
Spicy mayo
Sweet and sour

What do you get from de Hoek?

Eierbal
Hamburger
Kroket
Kip burger

Favorite insect?
  Bee
  Dragonfly
  Ladybug
  Praying mantis

Favorite Disney movie?
  Brave
  Lilo & Stitch
  Tangled
  Tinkerbell franchise

Go-to soup?
  Mushroom and potato
  Mustard
  Tomato
  Ramen

Favorite music genre or band?
  Pop
  Florence and the Machine
  The Cure
  R&B

What's your favorite quote or saying?
  Babygrill instead of babygirl
  "What I'm about to do has not been approved
  by the Vatican"
  "None of those words are in the Bible"
  Skill issue

Favorite ice cream flavour?
  Belgian chocolate
  Coffee
  Lemon
  Strawberry

If you could learn any skill instantly, what would it be?
  All languages
  Painting
  Becoming a coding master
  Hacking

Best concert you ever attended?
  Arctic Monkeys
  Florence and the Machine
  Film music in concert
  Hozier

If you could live anywhere in the world, where would it be?
  Australia
  Norway
  Scotland
  Pacific Northwest

If you could travel anywhere in time, where would you go?
  Dinosaur time
  The 70s
  1000 years into the future
  2000s to relieve my childhood

Answers!

Now that you completed the quiz, you have a chance to compare the answers with the committee's.

Favorite shade of green?

Emerald green	**Stefi**
Forest green	**Ioana**
Pine green	**RoMo**
Yellow	**Yoana**

Go-to restaurant in the city?

De Pastafabriek	**RoMo**
Fat Phills	**Stefi**
Otacos	**Yoana**
Poke spot	**Ioana**

Favorite type of weather?

Rainy while inside	**Ioana**
Stormy	**RoMo**
Snowy	**Stefi**
Sunny but not too hot	**Yoana**

What object would you want to have with you if stranded on an island?

Boat	**RoMo**
Book	**Yoana**
M16 Rifle	**Ioana**
Sharp knife	**Stefi**

What is your favorite beer?

Desperados	**Stefi**
Cherry chouffe	**Yoana**
Kasteel Rouge	**RoMo**
Tripel Karmeliet	**Ioana**

Favorite non-alcoholic drink?

Aloe vera juice	**Stefi**
Iced oat latte	**Ioana**
Smoothie	**Yoana**
Water	**RoMo**

What superpower would you like to have?

Lightning wielding	**Ioana**
Mind reading	**Stefi**
Telekinesis	**RoMo**
Time travel	**Yoana**

Favorite scent?

Bourbon vanilla	**Ioana**
Citrus	**Yoana**
Freshly cut grass	**RoMo**
Hyacinth	**Stefi**

Go-to sauce for fries?

Mayonnaise	**RoMo**
Mustard	**Stefi**
Spicy mayo	**Ioana**
Sweet and sour	**Yoana**

What do you get from de Hoek?

Eierbal	**Yoana**
Hamburger	**RoMo**
Kroket	**Stefi**
Kip burger	**Ioana**

Favorite insect?

Bee — **Yoana**
Dragonfly — **Ioana**
Ladybug — **RoMo**
Praying mantis — **Stefi**

Favorite Disney movie?

Brave — **Stefi**
Lilo & Stitch — **RoMo**
Tangled — **Yoana**
Tinkerbell franchise — **Ioana**

Go-to soup?

Mushroom and potato — **Ioana**
Mustard — **Stefi**
Tomato — **RoMo**
Ramen — **Yoana**

Favorite music genre or band?

Pop — **RoMo**
Florence and the Machine — **Yoana**
The Cure — **Stefi**
R&B — **Ioana**

What's your favorite quote or saying?

Babygrill instead of babygirl — **Stefi**
"What I'm about to do has not been approved by the Vatican" — **Ioana**
"None of those words are in the Bible" — **RoMo**
Skill issue — **Yoana**

Favorite ice cream flavour?

Belgian chocolate — **Ioana**
Coffee — **Stefi**
Lemon — **Yoana**
Strawberry — **RoMo**

If you could learn any skill instantly, what would it be?

All languages — **Yoana**
Painting — **RoMo**
Becoming a coding master — **Stefi**
Hacking — **Ioana**

Best concert you ever attended?

Arctic Monkeys — **Yoana**
Florence and the Machine — **Stefi**
Film music in concert — **RoMo**
Hozier — **Ioana**

If you could live anywhere in the world, where would it be?

Australia — **Yoana**
Norway — **Stefi**
Scotland — **RoMo**
Pacific Northwest — **Ioana**

If you could travel anywhere in time, where would you go?

Dinosaur time — **Stefi**
The 70s — **Yoana**
1000 years into the future — **RoMo**
2000s to relieve my childhood — **Ioana**

Meet the Board
The 66th Board of the FMF is now a fact!

AUTHOR: **Y. SAVOVA**

If you have not had the chance to meet them so far, you are probably full of questions. Worry not! As always, the Perio*diek* has your back! With these five short introductions, we aim to show you what's in store for the FMF and make you excited about the new year ahead of us. And for those of you that are still curious, you will be able to catch all of the board hanging out in the FMF room (make sure to say hi!) and read more "From the Board" sections in the upcoming issues.

Marnick

Name: Marnick Pieter Johannes Eriks

Study: BSc Applied Physics

Year started: 2022

Position: Chair

Favourite committee: A-Team

Thing you love most about the FMF: I love going to the members' room after a lecture and chilling for a while, enjoying a nice cup of tea

Ioana

Name: Ioana Roxana Balint

Study: BSc Astronomy

Year started: 2022

Position: Secretary

Favourite committee: Periodiek - in the streets and the sheets

Thing you love most about the FMF: Hanging out in the room and playing darts

Jorian

Name: Jorian Thijmen Pruim

Study: MSc General Mathematics

Year started: 2021

Position: Treasurer

Favourite committee: LANcie

Thing you love most about the FMF: The ingenuity and resourcefulness of the members

Yoana

Name: Yoana Savova (not to be confused with Ioana)

Study: BSc Physics

Year started: 2022

Position: Commissioner of Internal Affairs

Favourite committee: Perio (objectively the best) with Symcie a close second

Thing you love most about the FMF: The people <3

Aurélien

Name: Aurélien Schmitt

Study: BSc Physics and BSc Mathematics

Year started: 2022

Position: Commissioner of External Affairs and Educational Affairs

Favourite committee: Lucie - the force is strong with this one

Thing you love most about the FMF: The vibrant, diverse and nerdy community

Northern Lights
An FMF x Sirius A collaboration

AUTHORS: **R. MOL, M. LIMA**

We usually associate the Northern Lights with... well, being visible in Northern countries. However, in May and in October this year, something amazing happened. Some of us were lucky enough to clearly see the Aurora Borealis above our heads. This was visible in Groningen, but also in some other countries even further down South. If you were unlucky like some of us and did not see the Aurora, possibly because you were too busy sleeping, let go of your sadness: Sirius A and FMF decided to collaborate and write an article about aurorae just for you!

What causes the Northern Lights?

Our sun is constantly sending heat and light towards the Earth. Next to that, it also sends a constant stream of charged particles, such as electrons and protons, towards us. This is called the solar wind of the sun, and just like the wind we experience from the weather, it isn't constant. Solar flares or coronal mass ejection can send larger waves of these charged particles towards the Earth, these events are also called solar storms [1][2][3].

The magnetic field of our planet protects us from most of these solar winds and storms by slowing and redirecting the particles. The particles that do reach Earth, usually around the poles, get trapped by the magnetosphere and interact with the gases in our atmosphere. When the charged particles react with oxygen and nitrogen, they light up the sky and this is what we call the Northern Lights [1][2][3].

Different Colours of the Northern Lights

Did you know that aurorae come in different colours? You might have the chance to observe some pink ones, or red, blue, purple... but the most common colour seems to be green [4]. This has to do with the altitude at which the solar particles collide with the Earth's atmosphere, since at different altitudes different gases are present. The most common colour, green, happens when the charged particles interact with oxygen. But did you know that this can also cause red light to appear? When the particles interact with nitrogen, the colour is instead blue or purple.

Other planets

Aurorae don't just happen here! Because the only things you need are an atmosphere and a magnetic field (and a nearby sun), other planets can have aurorae as well. For example, Jupiter and Saturn have been observed to have aurorae at their poles from time to time too.

On Jupiter specifically, the aurora does work slightly differently than here on Earth. Jupiter has a stronger magnetic field than Earth does, and so it collects more charged particles, particularly from its moon Io. The many large volcanoes on Io spew particles into space which, together with the solar wind, is caught by Jupiter. This means that the aurorae at Jupiter are not only more energetic than the one on Earth, but also much less rare. In fact, they never stop! [5][6]
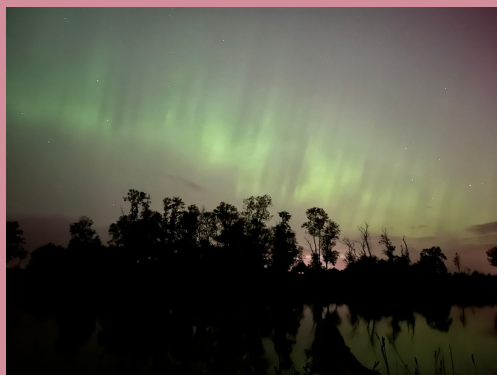

Figure 17: Photo by Florence Reymonet and Micheal Christodoulou. Northern Lights in Groningen, October 2024

Some tips to observe the Northern Lights

You won't have many chances of observing the Northern Lights, unless you travel to some nordic countries. However, some things might help you be prepared for the next time the northern lights decide to bless us in the Netherlands. Since having missed the northern lights in May, I immediately signed up for an online newsletter which sends you an email alert every time the Northern lights might be visible in Groningen. The website is noorderlichtjagers.nl . It is in Dutch, and so are the emails, but fortunately technology has given us Google Translate.

Another tip is to check whether the sky will be cloudy or not, and to travel to a place with less light pollution than Groningen when you get one of those alerts. You also want to make sure you find a spot from which you can clearly see the sky when you look North. That reminds me of the last tip: don't forget to look North! Pack your compass and have fun, or simply get distracted trying to spot the Milky Way or some cool new constellations. Either way, aurorae or no aurorae, you'll have a fantastic time stargazing with your besties.

Aurora Australis

If you ever find yourself bored in the Southern hemisphere, with a very sudden urge to see some aurorae, rest assured. You can also see aurorae in the Southern hemisphere!

The process behind the Aurora Australis (the word "australis" comes from auster, which is latin for the "South wind" [7]) is the same behind the Aurora Borealis. It might, however, be harder to observe these lights as they occur mostly over the Southern Ocean and Antartica. What a great excuse to hop on a boat and start your new adventure!

Sources

[1] https://spaceplace.nasa.gov/aurora/en/

[2] https://www.bbc.com/news/science-environment-26381685

[3] https://www.rmg.co.uk/stories/topics/what-causes-northern-lights-aurora-borealis-explained

[4] https://perlan.is/articles/northern-lights-colours

[5] https://science.nasa.gov/missions/hubble/hubble-captures-vivid-auroras-in-jupiters-atmosphere/

[6] https://smd-cms.nasa.gov/wp-content/uploads/2023/07/hubble-jupiter-aurora.pdf

[7] https://cooljugator.com/etymology/lat/australis

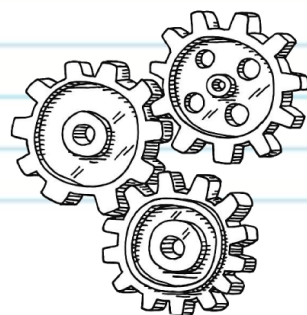**Figure 18:** Photo by Harsh Daryanani, @harshdphotography. Northern Lights in Baflo, May 2024

The Periodiek Presents:

Writing competition
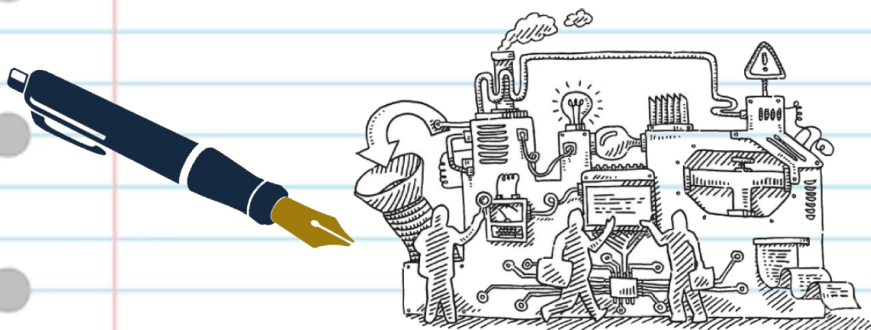
Deadline: November 20th

Write a short story (500 - 1500 words) based on the prompt:

"What secret techonology is the University hiding in the Nijenborgh?"

Send your submission to perio@fmf.nl

Best submision(s) will get featured in the next issue!

Recipe
Sticky Tofu Noodles

AUTHOR: **S. CHULEI**

Preparation time: ∼ 20 minutes
Portions: 2 to 3 servings
Allergen information: wheat (gluten), soy.

For this issue, we have a recipe shared by the Vegan Student Association Groningen. They are a community of vegan-interested individuals. You can find more information about them on their Instagram page.

Ingredients
- 150g dry noodles
- 300g firm tofu
- 150g oyster mushrooms
- 4 spring onions
- 50ml water
- 5tbsp corn starch
- 3tsp white sugar
- 100ml sunflower oil
- 50ml soy sauce

Preparation

1. If you are not very hungry yet, you can start by pressing your tofu: get it out of the package, put some paper towels under and on top of your block of tofu, then put some extra weight on top, like a few cooking pans, leave it like that for up to half an hour. This will squish water out of your tofu giving it a better texture for cooking. If you don't feel like it, you can skip this step and just pet-dry your tofu when you get it out of the package.

2. Fill a pan with water and bring it to a boil. Then follow the instructions on the package of the noodles you bought, usually, they will take between 5 and 15 minutes in boiling water to be fully cooked. When the noodles are done, drain them and leave them to cool down.

3. While waiting for your noodles, cut up tofu into cubes with sides of about 1cm and transfer them to a big bowl. Add 4 tbsp of cornstarch and mix gently. Cornstarch should cover tofu blocks on all sides, add more cornstarch if needed. Leave it for a few minutes.

4. Chop the mushrooms into pieces similar in size to your tofu blocks. Then chop the onions into 5mm thick rings, you may want to separate the white and the light-green parts for frying and the dark-green part for the garnish.

5. In a glass, mix water, soy sauce, sugar, and 1 tbsp of cornstarch. Stir the mixture with a spoon until the sugar is fully dissolved and you don't have any clumps of cornstarch. This will be our sauce later.

6. Put a frying pan on medium-high to high heat. When the pan is getting hot, add oil to fully cover the bottom. Put the tofu blocks in the pan one by one so that each piece touches the bottom of the pan. Fry them for 2-3 minutes or until golden brown on one side. Then flip each tofu block and fry on another side for 1-2 minutes again. At this point, your tofu blocks should be quite crispy. When that is the case, move them to a clean dry bowl without the access oil from the pan.

7. Add the onions and mushrooms to the frying pan (the one you have been using for tofu) and cook them for about 1-2 minutes while stirring occasionally. Give your sauce mix from spet 5 a quick stir (to avoid all the cornstarch sitting on the bottom) and pour it in the pan with onions and mushrooms. Reduce the heat to medium and let the sauce simmer until it becomes think and sticky. Add the tofu back to the pan, mix everything together, and turn the heat off.

8. Serve the noodles in a bowl with the fried tofu on top. You may add some chopped spring onions as a garnish. Enjoy!
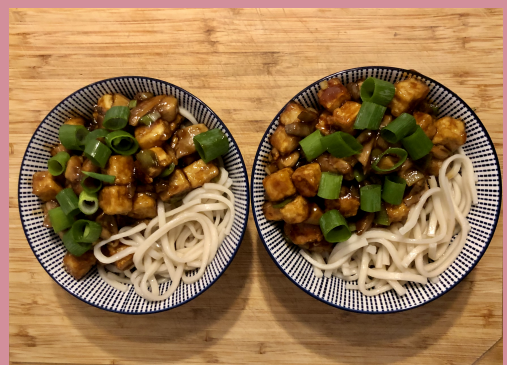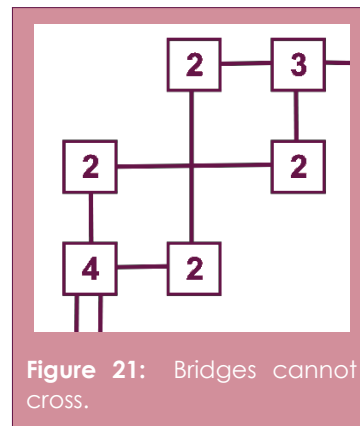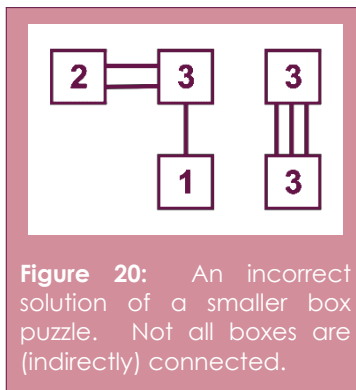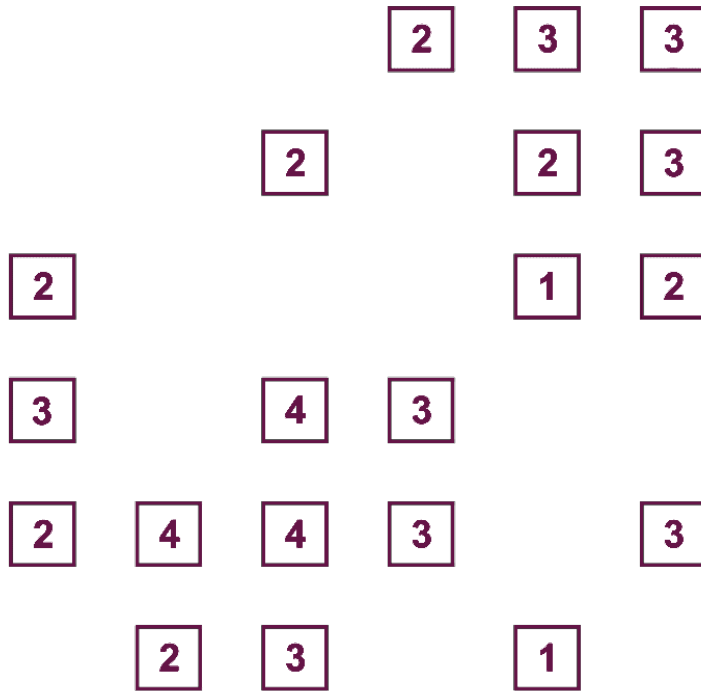

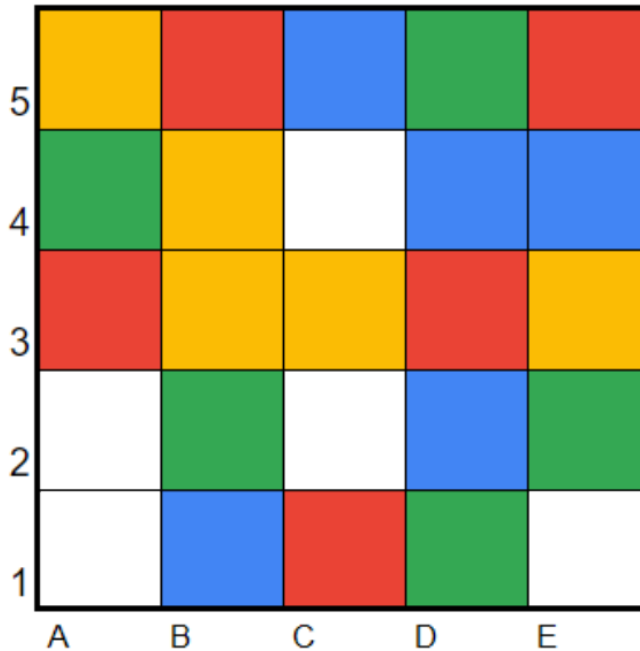**Figure 19:** Sticky Tofu Noodles

Brainwork
Boxed Bridge Builders

AUTHOR: **R. MOL**

Connect each of the boxes to other boxes by drawing exclusively horizontal en vertical lines (bridges) such that each box is connected to any other box via a series of bridges. Each box shows the amount of bridges connected to that box in the solution. Each side of each box can have at most 3 bridges. Bridges may not intersect each other. Multiple solutions may be possible!


Figure 20: An incorrect solution of a smaller box puzzle. Not all boxes are (indirectly) connected.

Figure 21: Bridges cannot cross.

# Solution to the previous Brainwork

1. There exists exactly 1 column that contains all colours.
2. There exists a colour, other than yellow, such that each yellow square neighbours this colour.
3. There exists a white square that neighbours only red squares.

4. Each blue square neighbours exactly 1 other blue square. **[C2 is Green]**
5. Each colour appears equally often. **[B1 is Blue]**
6. No red square neighbours a red square or is diagonally connected to a red square and no green square neighbours a green square. **[D4 is Blue]**

7. All rows and columns are unique.
8. At least one of the rows contains the Romanian flag (from left to right: Blue, Yellow, Red).
9. Each column contains at least one red square.

10. There exists exactly 1 white square that neighbours every other colour.
11. One of the diagonals contains all colours. **[E4 is Blue]**
12. If a 2x2 area has 3 squares of the same colour, then all squares in that 2x2 area have the same colour.

13. The middle row has exactly two colours, each appearing at least twice. **[D5 is Green]**
14. A1 has the same colour as A2.
15. There are exactly 2 rows with exactly 3 green squares each. **[C5 is white]**

This puzzle was correctly solved by Hannah Jager, who also found a second solution with C4 and E2 swapped. Pictured here to the right.
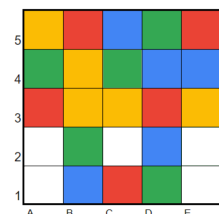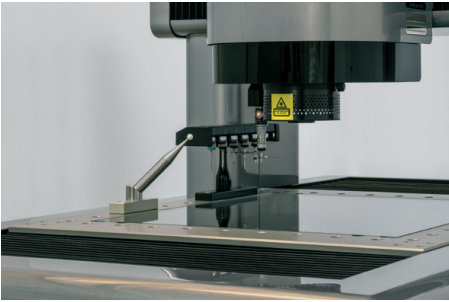
Schut Geometrical Metrology is an international organization, founded in 1949, specialized in the development, production, sales and service of precision measuring instruments and systems. Our 3D CNC coordinate measuring machines DeMeet are completely developed in Groningen. This entails mechanics, electronics and software.
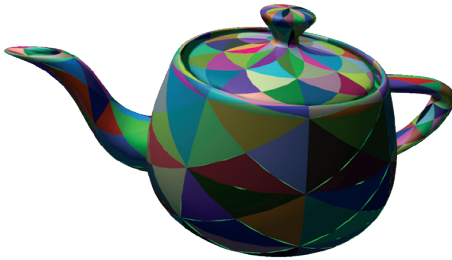
We offer positions for careers, internships or graduation projects involving a wide variety of technical subjects. Previous projects include topics such as adaptive tessellation using Bézier patches, fit algorithms for geometrical shapes from point clouds, optical lens system design, computational fluid dynamic analysis for air bearing designs and Monte Carlo raytracing.
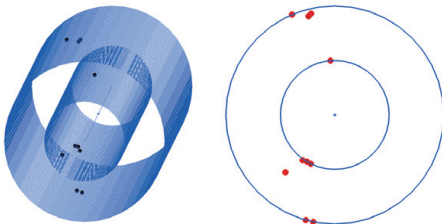
For various departments we are looking for new colleagues. This includes *software (C++), mechanical and electronics developers and engineers or technical sales and support engineers*. We are in particular interested in any person who completed at least two parts of the courses "Programming in C/C++" at the R.U.G.
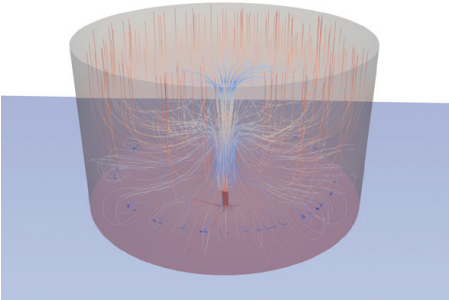
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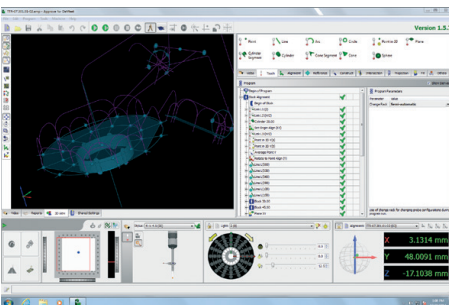
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