+ Dieser Ticker wurde während der VMP Vorstandssitzung geschrieben bei der ich nicht aufgepasst habe +++ Michelle erwischt b ülkoh

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VISIONEN

BACK TO SCHOOL

Magazin des Vereins der Informatikstudierenden an der ETH Zürich (VIS)

VIS & Official

ETH & Studies

VISIONEN & Interesting

FUN & Distraction

Editorial

Ærac hæm цу цæут,
Dear first years, I hope your first few weeks have gone splendidly! And dear non-first years, I hope you had any semblance of vacation before the semester start, as this year will be jampacked with fun, stress and anger against Swiss politics.

In your hands (or on your computer/phone/microwave/.. screen) you're currently holding (or staring at) your best friend for the rest of your studies, the Visionen!

This is not just the by far best newspaper to have ever been created by VIS, it also offers you a portal to a world you have not seen before: the written down thoughts of the Visionen writers.

In this edition, we will be presenting to you the greatness of writing (you should absolutely join Visionen and write!), the fantastic future of VIS (you should absolutely become VIS active and have fun!), the tremendous work of Professor Thomas Michaels (you should absolutely take a look at his textbook!), and plenty more (you should absolutely read through everything!)

I wish everyone except the one French airport security guy who mocked for what he thought was me mocking France but actually just saying 'yes' to his answer a pleasant read of this edition.

Дæ фæндаг раст,
Benjamin Gruzman

Präsikolumne

JONAS - WELCOME ERSTIS AND GOODBYE OLD BOARD

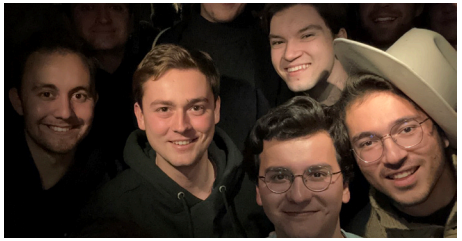
Hello everyone!
A new semester has begun. Welcome to all the new faces! I hope you've already acclimated to your new life at ETH! A memorable, sometimes painful, but also fun journey awaits you!

I would like to recap some of the activities that took place during the off-semester period.
We had monthly board meetings where we discussed various plans for this semester. We discussed motions for the general assembly and changes to our statutes. Apart from that, DepKo organized the Ex-Actives BBQ, where former VIS members were invited to come and socialize. It was a great experience and so insightful to hear about all the stories of times past.
Right before the semester began again, VISKAS took place at the Katzensee. The actives had a fun evening to gather and share moments.

Our plans for this semester are great as usual: By the time you read this, VIScon will have already taken place, being our biggest event of the Semester. Afterwards follows the "Heimwoche", which is a concept that some people who grew up in Switzerland might know about. The idea is that we rent a house for a week, where people get to eat dinner and sleep, but during the day, we all go to ETH and study. Fun events are planned in the evenings, and it's sure to be a memorable experience.

During the weekend from the 31st of October until the 1st of November, BjörnCTF will be happening. It's a CTF organized by our very own CTF committee, and it's going to be a fun challenge for anyone who wants to get into CTFs. For the bachelor students who recently graduated, we will be hosting the annual Bachelor Graduation ceremony. We are very grateful for the support given to us by the Department.

Another highlight later in the semester is going to be the FIGUGEGL[1], taking place on the 28th



[1] Stands for "Fondue isch guet und git gueti Luune", Swiss german for "Fondue is great and gives you a good mood"

of November. FIGUGEGL is our annual fondue event, hosting 600 people. Fun fact: It is becoming increasingly difficult to rent the sheer number of caquelons required to do the event at that scale. The record for the biggest fondue in Switzerland is held by a local football club in Semsales with over 3000 participants. We are still short of that, but maybe in 10 years…

This is my last Präsikolumne that I'm writing for VISIONEN. I remember writing my first one, for the second edition of 2024, one and a half years ago. The byline of the article was "somehow got into this mess", and I think that puts it pretty well. The past one and a half years have been enormously memorable, fun, but also exhausting at times. Still, if I were in the same situation, I would do it all over again. I've had the privilege of serving on 4 different VIS-boards, all with their unique quirks and people. The amount of networking with companies, students, student associations, and even professors that I've experienced was unparalleled. The two total years on the board have flown by, but also somehow felt like an eternity. I have so many more fond memories from these past 2 years than from the 3 preceding years of my Bachelor's degree, which was mostly characterized by Covid-19 and constant lockdowns, and changing regulations. I'm so grateful for the opportunities that VIS has provided me, especially when it comes to organizing events. I don't know when, if ever, I will have the chance to create events for so many people again. All in all, I was involved in at least 43 events during my VIS-career. I was so on the fence about joining the event and party committee (FKK), because I thought "no, I don't like organizing events". It seems that VIS has revealed this passion for me.

If anyone is still on the fence about student associations, all I can say is "don't be!". Now is the right moment to become active. We have so many committees and groups within VIS, so it is almost guaranteed that you will like something. If you want to check out what groups and committees we have, go to join.vis.ethz.ch to find out more.

That's it from me for now. Thank you for the last 2 years, it has been a blast!

With lots of love,
Jonas

Hopokolumne

With the start of a new semester, we want to extend a warm welcome to all the new Ersties who may not be familiar with VIS' HoPo and what we do. So, here's a quick introduction to HoPo and how we're here to support you. Our mission is to address your concerns, improve your experiences, and advocate for your rights within our academic community.
Whether you're struggling with coursework, dealing with professor-related issues, or looking to enhance the overall quality of your education, we've got your back! Always feel free to reach out to us under **hopo@vis.ethz.ch.**

Since the last Visionen article, our main focus has been PAKETH—an ETH-wide reform of the academic calendar and examination system. Elmar and I have joined a departmental taskforce reviewing the overall structure of the computer science curriculum. This group has considerable freedom, so our input can truly shape the outcome.

We're discussing these topics internally, but we'd love to hear from you as well. For example, if you think certain courses should be scheduled later to ensure sufficient background knowledge, or if you believe the Bachelor's curriculum should offer a different selection of basic or core courses, let us know. If these ideas resonate with other students and the task force, changes can be implemented much more easily than before, or after, PAKETH.

In addition, we're in direct contact with the PAKETH core team, particularly on workload management within the Computer Science program. We're also actively addressing several issues in various courses that were brought to our attention during and after the exam season. These range from simple complaints about course structures to more serious concerns about grading practices. If you're facing challenges or need a strong ally to support you, don't hesitate to contact us at **hopo@vis.ethz.ch**!

We hope you had an amazing break and are ready for another great semester ahead!

On a side note, you'll probably hear less about the Bachelor Graduation and the Teaching Awards in future Hopokolumne updates, as these responsibilities have moved to a board taskforce and the LUK (Lernunterstützungskommission).

■

Survival-Guide für Erstis

Willkommen im Informatikstudium an der ETH Zürich! Der Studienstart kann überwältigend sein: Man wird mit Informationen überhäuft, hört Tipps von allen Seiten und sieht sich plötzlich mit unzähligen Möglichkeiten konfrontiert. Dieser Guide soll dir helfen, den Fokus zu behalten und das erste Jahr erfolgreich zu meistern – ohne dich zu verzetteln.

1. Fokus auf die Basisfächer

Im ersten Semester ist es entscheidend, sich auf die vier Basisfächer und deren Vorlesungen, Übungsstunden und Hausaufgaben zu konzentrieren. Es gibt viele zusätzliche Lernangebote (Mentoren Programm, Nachhilfe oder sonstiges), aber ihr müsst nicht an allem teilnehmen. Wählt höchstens ein Angebot, das euch persönlich weiterbringt, und lasst euch nicht vom Gefühl treiben, überall dabei sein zu müssen. Das führt zu mehr Stress als es hilft. Es gibt viele Angebote, weil viele Personen an der ETH unterschiedliche Lerntypen haben, aber das bedeutet nicht, dass man selber um bedingt alles machen muss, um die besteh Chancen zu verbessern. Konzentriert euch auf das wesentliche.

2. GESS-Fächer? Noch nicht!

Viele möchten die Geistes- und Sozialwissenschaften (GESS) direkt „erledigen". Unser Rat: Hebt euch das erste GESS-Fach für das zweite Semester auf. Im Sommer habt ihr neun Wochen Zeit für die Prüfungsvorbereitung – deutlich mehr als die vier bis fünf Wochen im Winter. Nutzt das erste Semester, um euch auf das Informatikstudium einzulassen und euren Rhythmus zu finden.

3. Clubs & Projekte – später!

An der ETH gibt es zahlreiche spannende Projekte, Clubs und Initiativen. Doch auch hier gilt: Erst das Studium, dann das Engagement. Ihr habt noch viele Semester Zeit, euch bei ARIS, im Student Project House oder anderswo einzubringen.

Besonders wichtig: Das eigentliche ETH-Tempo setzt oft erst in der dritten Woche richtig ein. In den ersten beiden Wochen wirkt vieles noch entspannt – genau dann ist es verlockend, sich für zig Nebenaktivitäten einzuschreiben oder Verpflichtungen einzugehen. Doch das kann sich schnell rächen. Sobald die Hausaufgaben anlaufen, kann die Belastung sprunghaft ansteigen.

Deshalb: Wartet ab, bis ihr das echte ETH-Pensum erlebt habt. Fangt frühestens im zweiten Semester an, euch neben dem Studium zu engagieren – so könnt ihr besser Prioritäten setzen und lauft nicht Gefahr, euch gleich zu Beginn zu überfordern.

4. Plant eure Woche

Ein klarer Zeitplan ist Gold wert. Legt feste Zeiten für Vorlesungen, Übungsstunden, Hausaufgaben, Prüfungsvorbereitung und auch für Pausen fest. So vermeidet ihr Last-Minute-Stress und habt bewusst Raum für Erholung und Freizeit.

Richtet euch dabei an der empfohlenen Wochenarbeitszeit von 40 bis 50 Stunden aus. Das entspricht einem Vollzeitjob – aber auch nicht mehr. Es geht darum, genügend, aber nicht zu viel zu arbeiten. Wer dauerhaft über diese Zeit hinausgeht, riskiert Überforderung. Wer deutlich darunter bleibt, läuft Gefahr, zurückzufallen.

(Timetable Vorschlag ist beigefügt, jemand muss das noch schön machen)

5. Lernt aktiv – nicht passiv

Ein essenzieller Punkt für euren Studienerfolg ist der Unterschied zwischen aktivem und passivem Lernen – auch wenn das anfangs gar nicht so leicht zu erkennen ist.

Viele glauben, sie lernen „effizient", wenn sie nur alte Prüfungen durchgehen oder sich Lösungen anschauen. Manche sagen sogar, man könne sich die Übungsstunden und Hausaufgaben sparen – aber das ist einer der schlechtesten Tipps, den man im ersten Jahr bekommen kann. Man schaut sich einfach ein Aufgabenblatt an und man merkt schnell, dass es sehr ähnlich aussieht wie eine Aufgabe in einer alten Prüfung.

Die Wahrheit ist: Wer die Übungen regelmäßig selbst bearbeitet und an den Übungsstunden teilnimmt, schneidet nachweislich besser ab. Die Inhalte von Vorlesung, Übungen und Prüfungen sind gut aufeinander abgestimmt. Wer diese Gelegenheiten nutzt, lernt viel nachhaltiger.

Doch was genau bedeutet „aktiv lernen"?

Es bedeutet, dass ihr die Aufgaben wirklich selbst durchdenkt und löst – von Anfang an.

Und hier liegt die große Schwierigkeit:

Viele Aufgaben bestehen aus mehreren Schritten. Oft passiert es, dass Studierende nach kurzer Zeit den ersten Schritt nicht verstehen und dann – nach 5 Minuten Grübeln – einfach abschreiben oder sich den Lösungsweg zeigen lassen. Die restlichen Schritte bearbeiten sie dann selbst und haben das Gefühl, „die Aufgabe verstanden zu haben".

Doch in der Prüfung fehlt dann genau dieser erste Schritt – und ohne ihn kann man die Aufgabe oft gar nicht beginnen. Gerade dieser erste Schritt ist oft der wichtigste, weil er das Problem erschließt.

Und genau das macht aktives Lernen so schwer greifbar: Es gibt keine klare Zeitvorgabe, wie lange man an einer Aufgabe arbeiten „muss", um sie aktiv gelernt zu haben. Jeder Mensch ist unterschiedlich. Und: Es fühlt sich oft nicht produktiv an, stundenlang an einer Aufgabe zu knabbern. Aber genau das ist aktives Lernen.

Wenn eine Aufgabe zwei oder drei Stunden dauert, ist das nicht ungewöhnlich – vor allem am Anfang. Wichtig ist: Wenn ihr euch wirklich durchbeißt, wird es mit der Zeit viel schneller. Eine Aufgabe, für die ihr anfangs zwei Stunden gebraucht habt, könnt ihr in der Prüfung oft in 15 Minuten lösen. Das ist genau der Lerneffekt, der euch später hilft.

Natürlich hat jede*r einen eigenen Lernstil. Manche besuchen jede Vorlesung, andere arbeiten lieber mit dem Skript. Beides ist okay – solange ihr am Ende ehrlich zu euch selbst sagen könnt: Ich verstehe den Stoff, und ich kann Aufgaben eigenständig lösen. Und solange ihr auf etwa 40 bis 50 Stunden Lernzeit pro Woche kommt, passt der Rahmen.

Wer weniger macht, riskiert Lücken – wer deutlich mehr macht, läuft Gefahr auszubrennen. Es geht darum, nicht planlos Zeit zu „investieren", sondern gezielt aktiv zu arbeiten.

6. Sucht euch Freundschaften – das bringt euch weiter (auch wenn ihr introvertiert seid)

Das Informatikstudium ist fordernd – fachlich wie emotional. Aber ihr müsst da nicht allein durch. Einer der wichtigsten Tipps für euer erstes Jahr ist: Sucht euch früh gute Leute.

Echte Freundschaften bringen nicht nur Motivation, sondern sind auch fachlich ein echter Gamechanger.

👉

Ihr werdet während des Studiums oft die Möglichkeit haben, gemeinsam zu arbeiten – bei Übungen, Lerngruppen und später auch in Gruppenprojekten. Und ehrlich gesagt: Ich habe fast alle Gruppenarbeiten mit Leuten gemacht, die ich im ersten Jahr kennengelernt habe. Es lohnt sich also, sich früh ein gutes Netzwerk aufzubauen – Menschen, auf die man sich verlassen kann, fachlich wie menschlich.

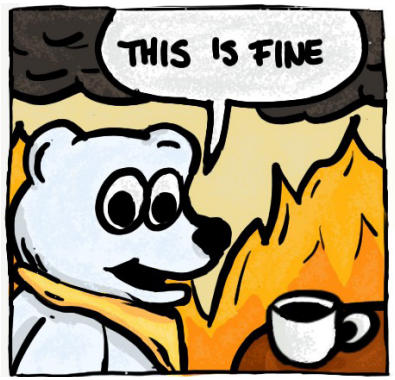
Natürlich fällt es nicht jedem leicht, einfach auf Leute zuzugehen – gerade in einem Studiengang, wo viele eher introvertiert sind. Aber genau das ist eure Chance! An der ETH Informatikstudieren fast nur Leute, die selbst eher ruhig oder schüchtern sind. Es ist wahrscheinlich noch nie so einfach gewesen, Freundschaften zu schließen, wie in diesem Umfeld.Sprecht einfach die Sitznachbarin oder Sitznachbaren in eurer Vorlesung an und fragt, ob ihr zusammen Lernen oder Essen wollt.

Wenn ihr euch traut, diese erste kleine Hürde zu nehmen, werdet ihr erstaunt sein, wie viele ähnliche Leute ihr trefft – und wie viel angenehmer das Studium dadurch wird. LAN-Partys, Lerngruppen, gemeinsame Mittagessen oder einfach nur gegenseitiges Zuhören – all das hilft, durchzuhalten.

Und noch ein Tipp: Wenn ihr jemandem eine Aufgabe erklären könnt, merkt ihr sofort, ob ihr den Stoff wirklich verstanden habt. Lehren ist einer der besten Wege zu lernen.

8. Vergleich dich nicht zu sehr – du bist nicht hier, um jemand anderes zu sein

Gerade im ersten Jahr fällt es vielen schwer, einzuschätzen, wie gut sie im Studium unterwegs sind. Es gibt kaum Noten oder direkte Rückmeldungen – also orientieren sich viele automatisch an anderen:



„Der hat schon alle Hausaufgaben durch."

„Die hat in der dritten Klasse schon einen Compiler geschrieben."

„Warum verstehe ich das nicht in zehn Minuten wie alle anderen?"

Aber hier ist die ehrliche Wahrheit: Das ist gefährlich.

Die ETH zieht Menschen aus der ganzen Schweiz und darüber hinaus an – viele davon sind extrem akademisch begabt, manche haben in ihrer Freizeit schon unzählige Projekte gemacht oder mathematische Konzepte verinnerlicht, die ihr vielleicht gerade erst kennenlernt. Aber das sagt nichts über deinen Weg aus.

Lass dich davon nicht einschüchtern. Du musst niemandem etwas beweisen – außer dir selbst.

Was wirklich zählt, ist:

Arbeitest du kontinuierlich?

Nimmst du Herausforderungen ernst?

Verstehst du, was du tust, oder arbeitest du nur ab?

Wenn du das mit „ja" beantworten kannst, bist du auf dem richtigen Weg.

Ich selbst bin ein Beispiel: Ich hatte vor dem Studium keine Programmiererfahrung und bin einfach mit der gymnasialen Vorbereitung gestartet. Trotzdem habe ich mit einem Fünfer-Schnitt abgeschlossen. Warum? Weil ich drangeblieben bin, auch wenn ich anfangs nicht mithalten konnte. Und weil ich gelernt habe, dass es nicht um das Tempo anderer geht, sondern um meine eigene Entwicklung.

Es ist okay, wenn du anfangs langsamer bist. Es ist okay, wenn du Fehler machst. Solange du weitermachst, kommst du an.

9. Schreib die Prüfung im Winter – nur so weißt du, wo du wirklich stehst

Das ist wahrscheinlich der wichtigste Tipp überhaupt:

Schreibt die Basisprüfung im Wintersemester.

Es gibt Studierende, die schon nach wenigen Wochen das Gefühl haben, das Studium sei nichts für sie – vielleicht, weil sie sich überfordert fühlen, das ETH-Tempo unterschätzen oder sich mit anderen vergleichen. Manche denken dann: „Ich lasse es lieber gleich bleiben." Aber das ist ein Fehler.

Denn: Solange ihr die Prüfung nicht geschrieben habt, wisst ihr eigentlich gar nichts.

Ihr habt keine Noten, keine objektive Rückmeldung, keinen Anhaltspunkt dafür, ob eure Lernstrategie funktioniert oder wie viel ihr wirklich könnt.

Viele haben Angst, weil es bei der Basisprüfung nur zwei Versuche gibt. Aber genau dafür sind es zwei. Auch wenn es nicht klappt, ist das kein Weltuntergang – sondern eine konkrete Rückmeldung. Das Resultat gibt euch Orientierung.

Vielleicht merkt ihr:

„Ich war nah dran – ich bleibe dran und mache weiter."

„Ich habe bestanden, aber das ETH-Pacing ist trotzdem nicht mein Stil – ich wechsle an eine FH."

„Ich bin durchgefallen – aber jetzt weiß ich, woran ich bin."

würdet ihr all diese Entscheidungen nur auf Gefühl treffen – nicht auf Fakten.

Und noch etwas Wichtiges:

Die ETH nimmt in den ersten beiden Wochen oft nur langsam Fahrt auf. Viele Angebote starten sanft, Aufgaben sind noch moderat – aber ab Woche 3 geht es richtig los.

Gerade in diesen ersten zwei Wochen verpflichten sich viele zu Clubs oder Nebenprojekten und unterschätzen, was noch kommt. Manche schmeißen sogar schon das Studium, ohne je eine Prüfung geschrieben zu haben – und das ist wirklich schade.

Und was, wenn ihr die Prüfung nicht besteht?

Dann ist es trotzdem nicht vorbei. Die ETH ist flexibel aufgebaut. Ihr könnt zum Beispiel:

- im Frühling das Frühjahrsmodul (FS 1) machen,
- im nächsten Herbst das Herbstmodul (HS 1) wiederholen,
- dann mit dem zweiten Frühlingssemester (FS 2) weitermachen,
- und schließlich HS 2 abschließen.

Das funktioniert – und ist gar nicht so ungewöhnlich.

Zusammengefasst:

Die Prüfung im Winter zu schreiben heißt nicht, sich festzulegen – sondern, sich eine fundierte Entscheidungsgrundlage zu schaffen.

Noch Fragen?

Wenn ihr unsicher seid oder Hilfe braucht, könnt ihr euch jederzeit beim VIS (Verein der Informatikstudierenden) melden:

vis@vis.ethz.ch

vis.ethz.ch

Interview with
Prof. Dr Thomas Michaels

INTERVIEW BY: HÜSEYIN DENIZ - LOVES TALKING, HATES WRITING

TRANSCRIBED BY: JOHAN STETTLER - ALWAYS HAPPY TO PROCRASTINATE ON MY MASTER THESIS

For many Computer Science students, the journey through Calculus 1 and 2 (or "Analysis") is marked by one iconic book: the infamous "Michaels". Often called the essential guide that helps students survive the rigour of these courses, the book has earned a legendary status among those who have studied it. Today, we are honoured to sit down with the author himself, Prof. Dr. Thomas Michaels, Assistant Professor at the Department of Biology here at ETH.

Prof. Dr. Thomas Michaels Assistant Professor at the Department of Biology
https://biol.ethz.ch/

H: *Hello, Prof. Dr. Michaels. Thank you for taking the time to speak with us today. It's truly an honour to meet the author who guided so many of us through the challenges of calculus. To start, could you please introduce yourself to our readers and share a bit about your background?*

Prof. M: I am an Assistant Professor in the Department of Biology, specializing in the field of soft and living matter physics. This area of physics bridges the gap between traditional material science and biology. Soft materials, in contrast to classic hard materials like metals, are easily deformable. To give you an example, humans are mostly composed of soft materials—aside from our bones, of course.

The intriguing part of our work lies in studying materials that exhibit properties similar to those of living organisms. This is where biology becomes essential. We delve into understanding proteins and lipids, exploring what properties they possess and how these contribute to the behaviour of living systems. Ultimately, our primary question is: What makes a living cell a living cell?

I'm originally from Lugano, where I completed my high school education. From a very young age, I was drawn to the natural sciences, driven by a deep fascination with how the world works. I always had a strong connection to math—being able to memorize equations and formulas quickly—but I struggled a bit more with words. Math felt like a natural language to me, a language I could truly connect with, and this connection only deepened my passion for the subject.

As a child, I even had a small chemistry lab at home—very amateur, of course, and probably not up to safety standards. I loved experimenting with different reactions, and one time, I even had a small explosion, much to the displeasure of my parents. Needless to say, they weren't too happy about that! But these early experiences sparked my curiosity and set me on the path toward a career in science.

Afterward, I came to ETH Zurich to study chemistry. At the time, I was uncertain about which field to pursue, as I had a strong interest in several disciplines, including physics, biology, and chemistry. Natural sciences, in general, have always fascinated me. While I was drawn more to biology and chemistry due to their closer connection to nature, I found myself preferring physics for its rigour and its stronger mathematical formalization. Hence, after two weeks of studying chemistry, I swapped to physics and have stuck with it ever since.

Although I completed my Master's in physics here, I went to Cambridge to pursue my PhD in chemistry because I could never quite let go of it. During my research, I focused on Alzheimer's disease, and that's where my two passions truly converged. I was able to formulate mathematical equations that could be directly applied to the biochemical processes occurring in Alzheimer's disease.

Eventually, this passion for combining mathematical formalism with my interest in biology and chemistry led me to where I am now, here at ETH in the Department of Biology. It's a great place to be, especially since this department is very open and driven to use theoretical tools from physics and apply them to biology. This interdisciplinary approach is becoming more and more of a global trend, and that's precisely why I love being back here at ETH.

H: *Let's start by discussing the two books you've written—Calculus 1 and Calculus 2, which are used by nearly all students here at ETH. These books have become incredibly influential and are likely the reason many students succeed in these challenging courses. What inspired you to write these two books?*

Prof M: I've always loved teaching. Even back in primary school, I enjoyed explaining the things I was learning to my grandmother in a way that helped her connect with the subjects I studied. Naturally, when I came to ETH, I became a Teaching Assistant in Calculus because I enjoyed teaching and was very good at the subject.

My personal approach to studying and improving in any subject is to really sit down and try things out myself. This hands-on method has always been the most effective for me, and I've found that many people also respond well to this approach. However, I noticed that math, as a subject, is inherently very formal (which appeals to me), but unfortunately, it can be too rigorous for some people. Formalism is valuable, but what it often lacks is a more intuitive and practical approach. A combination of both formal and practical methods is, in my view, what is truly needed.

When I started working as a TA, I realized that I didn't quite like the way things were taught. The traditional approach involved handing out an exercise sheet, and the TA would give some hints to help you solve it, but it often still felt very abstract. As someone who is more practical by 👉

nature, I found this method less effective. For me, the learning process was more about seeing how a problem is solved step-by-step. I often had better experiences by first looking at a different example—one that was solved and explained in detail—and then solving multiple exercises on my own. This hands-on approach helped me connect the dots in a way that just didn't happen with the usual method.

Based on what I noticed from the students' needs, I started gathering exercises and materials from various sources to address the gaps, adding my own explanations and summaries. The goal was to unpack the theoretical concepts in a more detailed way, providing different examples to make things clearer. It was probably too effective, because my class grew from just a few students—around 10 to 12—to such an extent that they had to rent out a whole auditorium for my TA sessions. My friends even made a meme about it, joking that I had a "cult," and they'd count the new "high score" every year. At one point, I had around 150 students in my course!

This experience confirmed my belief that a combined approach to learning maths was essential. There was a missing link—while there were good books available, none of them addressed the gap between theoretical concepts and approachable exercises. After I accepted my PhD position in the UK, many students approached me, expressing their concern that my teaching would be lost if I left. I was surprised by this, but then I thought, "Why not just write my own book and publish it?" One of my student's mothers actually owned a publishing company, which helped make it possible.

I initially planned to write the book over the summer. It ended up taking about a year during my PhD. The book took off, and many students continue to write to me to this day, thanking me for providing these great teaching resources. I had a lot of fun writing it, and I'm really happy that so many students like it and have benefited from it.

It was also a nice experience to write the book as a reflection of my own learning journey. I revisited the topics I struggled with and rethought the strategies I developed to improve my understanding of mathematical concepts. It was a way to preserve those insights and share them with others. But beyond just being a reflection, I also loved writing it as a hobby. It was genuinely enjoyable for me—like drinking a very tasty cappuccino. I simply enjoyed the process of writing this book.

Writing the book also helped me develop skills that I could apply throughout my career, both in my PhD and in my research. I learned, especially, the skill of being concise with my words. I had to write in a way that balanced detail and correctness while covering as much theory as possible—without overloading the reader with too much information. This ability to find the right level of depth and clarity has been incredibly valuable for both teaching and research.

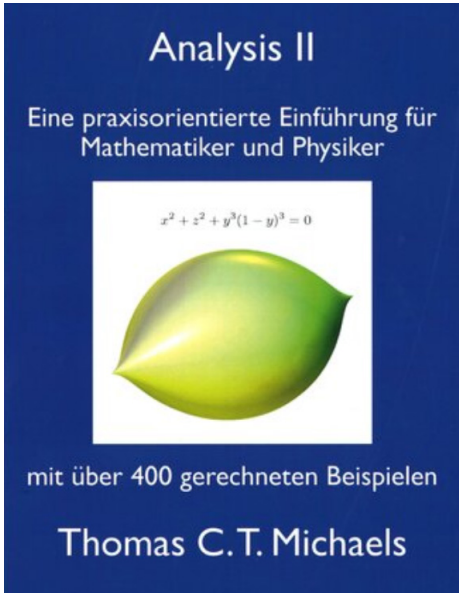
H: *Could you tell us more about the studies and research your group is currently working on?*

Prof M: In our research, we use theoretical tools such as statistical models and mechanics to understand complex biological systems, particularly proteins. Proteins are the fundamental building blocks of life. On their own, they are not very useful, but when they interact and aggregate in a specific way, they form various biological structures. However, these aggregations can sometimes go awry, leading to the development of several diseases, particularly neurodegenerative disorders such as Parkinson's disease, Type 2 diabetes, and others. We aim to analyse how these structures form and evolve over time. These processes can be viewed in terms of different phases—gas, liquid, or solid states—and the transitions between these phases are central to our research. By formulating these transitions mathematically, we seek to gain a deeper understanding of how these phase changes occur and contribute to disease progression. Ultimately, our goal is to identify ways to target and control these transitions, with the hope of developing potential treatments.

H: *Is there a particular computer science-related topic that you find especially interesting or relevant to your work?*

ProfM: We don't directly engage in bioinformatics ourselves, although we certainly make use of existing tools in our research. We don't develop them, but we leverage what's available. That said, machine learning and bioinformatics are rapidly growing fields with many applications. One topic that comes to mind, which is a bit different from classical bioinformatics, is cellular computation.

Cellular computation deals with understanding how cells "compute" in the sense of how they behave or react in specific ways. It explores questions like: How do cells integrate signals to produce outputs? This is an area that is also of great interest to my group, as the transitions of proteins are closely linked to cellular memory and computation.



Although we are still in the early stages of this field, I'm very excited to follow its developments.

H: *Do you have some projects CS Students could work with, for example a master thesis?*

Prof M: We actually have some computer science students doing research with us, and one of my PhD students is from computer science. We also have students from CSE. So yes, we do have projects available for master's theses if anyone is interested.

H: *What is one message you would like to send to our readers?*

Prof M: Do something you love. I'm very happy that I'm able to work in fields that I am truly passionate about. It's important to enjoy life and find joy in what you do.

Studium und Stipendium

BEGLEITET DURCH DAS EVANGELISCHE STUDIENWERK VILLIGST

Du liest das bestimmt gerade und denkst dir „Ein christliches Förderwerk? Da passe ich bestimmt nicht rein. Schliesslich bin ich nicht einmal christlich!“ Das dachte ich mir am Anfang auch, aber lass mich dir erzählen, warum das nicht unbedingt stimmen muss.

Was ist das Studienwerk?

Das Evangelische Studienwerk Villigst ist eines der 13 Begabtenförderungswerke Deutschlands. Es wird gefördert durch das Bundesministerium für Forschung, Technik und Raumfahrt (BMFTR) und von der Evangelischen Kirche in Deutschland (EKD). Zusätzlich ermöglichen Spender*innen das vielfältige Bildungsangebot.

Mein persönlicher Weg nach Villigst

In der Vorbereitung und Planung meines Studiums habe ich mich mit allen möglichen Förderwerken auseinandergesetzt. Ich fand vor allem die vielseitige ideelle, aber auch die finanzielle Förderung interessant. Dabei fielen mir besonders drei auf: das Evangelische Studienwerk Villigst, die Studienstiftung des deutschen Volkes und die Stiftung der deutschen Wirtschaft. Ich fand alle interessant und konnte mich gut mit ihnen identifizieren.

Als ich dann am Anfang über Villigst gelesen habe, dachte ich, dass ich nicht in das Raster passen und überhaupt nicht zur Zielgruppe gehören würde, weil ich nicht christlich bin. Aber umso mehr ich las, desto mehr verstand ich, dass es viel mehr um die Person geht und weniger um den Glauben. Also beschloss ich mich zu bewerben und wie du sehen kannst, hat es ziemlich gut geklappt!

Ein christliches Förderwerk?

Klar, in Villigst spielt der Glaube auch eine Rolle, aber auf eine andere Art, als du denken könntest. Denn der Glaube gestaltet vielmehr die Art und Weise, das Menschenbild, die Werte und vor allem wie wir miteinander umgehen. Wie ich bereits erwähnt habe, bin ich auch nicht christlich. Und dennoch fühle ich mich sehr wohl in Villigst und ich denke, das ist auch das Schöne an Villigst – solange du offen für eine liberale ideelle Förderung bist und den Austausch mit Menschen schätzt, die unterschiedlichste Fächer studieren und vielfältige Interessen mitbringen, kannst du in Villigst ein zweites Zuhause, eine zweite Familie und eine tolle Gemeinschaft finden.

Wie mich Villigst in meinem Studium unterstützt

Zuerst möchte ich sagen, dass Villigst mein Studium allgemein sehr bereichert. Ich habe durch die interessanten, vom Werk organisierten Seminare, Workshops und Veranstaltungen nicht nur Vieles gelernt, sondern auch neue, gute Freunde finden können, die ich sehr schätze. Auch ist es immer wieder schön, neue Sichtweisen zu Themen zu hören, die durch andere Studiengänge geprägt sind.

Nun aber zu der Unterstützung, die Villigst euch bieten kann. Das Stipendium besteht aus zwei Säulen:

Zum einen ist das die finanzielle Förderung, welche aus einer einkommensabhängigen Grundförderung (bis zum BAföG-Höchstsatz) besteht, die nicht zurückgezahlt werden muss. Es gibt jedoch auch eine einkommensunabhängige, monatliche Studienkostenpauschale, und sogar Zuschüsse für Auslandsaufenthalte, Praktika, Sprachreisen und Weiteres. Wie du sehen kannst, also eine ziemlich breite Palette. Das ermöglicht mir vor allem, dass ich mich während des Studiums nicht so sehr um das Finanzielle sorgen muss und weiss, dass ich noch interessante andere Angebote wahrnehmen kann.

Was ich persönlich aber fast schon spannender finde, sind die Möglichkeiten der ideellen Förderung. Das Themenspektrum der ideellen Förderung reicht von religiösen, zu politischen aber auch technisch interessanten Veranstaltungen. Besonders toll finde ich aber, dass wir ein demokratisches Gremium haben, das aus Stipendiaten und Stipendiatinnen besteht und aktiv mitbestimmen kann, wie das Jahresprogramm aussieht.

Das hört sich toll an – Welche Voraussetzungen gibt es für die Bewerbung?

Das Evangelische Studienwerk setzt folgende Aspekte für eine Bewerbung voraus:

- Gute Studienleistungen – Gefördert werden gute und sehr gute Studienleistungen. Du musst aber keinen perfekten Notenschnitt haben.

- Gesellschaftliches Engagement – Hierzu zählt vor allem ehrenamtliche Arbeit. Es könnte also dein Engagement im VIS, bei einem Jugendcamp, beim Roten Kreuz oder anderen Organisationen sein, die sich sozial, politisch, religiös oder auf eine andere Art für die Gesellschaft einsetzen.

- Insofern du im Ausland studierst, wie wir an der ETH, musst du die deutsche Staatsangehörigkeit besitzen. Wenn du beispielsweise planst, deinen Master in Deutschland zu machen, du aber aus der Schweiz, Liechtenstein oder einem EU-Land bist, kannst du dich auch bewerben. Weitere Informationen findest du auf der Webseite ***www.evstudienwerk.de.***

- Du darfst dein 3. Fachsemester nicht überschritten haben.

Bewerbungsprozess

Die Bewerbung erfolgt online. Dafür gibt es zwei Zeiträume: vom 1. Oktober bis zum 15. Januar (24 Uhr) und vom 1. April bis zum 15. Juli (24 Uhr). Sie besteht aus verschiedenen Dokumenten wie einem fachlichen Gutachten, einem Gutachten über das Engagement, einem Motivationsschreiben und einem Lebenslauf. Danach wird über deine Bewerbung beraten. Im Anschluss wirst du bei einer überzeugenden Bewerbung zum Vorauswahlgespräch eingeladen. Bei erfolgreichem Bestehen der Vorauswahl folgt die Hauptauswahl, in welcher es zwei Gruppengespräche und ein persönliches Gespräch gibt. Hier wird darüber entschieden, wer die Stipendien erhält.

Ich kann mich noch an meine Hauptauswahl erinnern und ich weiss noch, wie aufgeregt ich war. Aber schon damals ist mir aufgefallen, wie gut die Stipendiatinnen und Stipendiaten und die Bewerberinnen und Bewerber, die dort waren, zueinander passen.

Ich war wirklich beeindruckt, wie gut Villigst Menschen auswählt, die in das Werk passen.

Mein Fazit

Ich hatte am Anfang erwähnt, dass ich mir noch andere Werke angeschaut habe. Was ich nicht erwähnt habe, war, dass ich auch zu anderen Vorauswahlgesprächen und Hauptauswahlen eingeladen wurde. Du fragst dich sicher, warum ich dir das erzähle. Das ist ganz einfach – ich bin sehr froh, dass ich in Villigst (noch vor allen anderen) aufgenommen wurde und wünsche mir retrospektiv auch kein Stipendium eines anderen Förderwerks. Villigst hat mir so viele tolle Dinge ermöglicht, die weit über die finanzielle Unterstützung hinausgehen, tolle Freundschaften aus den verschiedensten Bereichen und Orten, wundervolle Erfahrungen und Erlebnisse und ein zweites Zuhause. Darum möchte ich dich auch dazu ermutigen dich zu bewerben. Vielleicht sehen wir uns ja einmal in Villigst.

THE SECIAS CORPUS:
CARE KILLED THE CAT

I sigh. My Analysis 1 exercises fly towards the useless decorative sink on my left. Great. Exactly what I needed…

Exhausted, I rub my dry, strained eyes and readjust my glasses. I lean towards the sink, reaching further and further. My body plummets off the wobble stool, but I stick the landing. Once steady, I step towards my papers landing site. Thankfully, they didn't scatter too far. I reach towards them but pause. The papers have landed atop something round and bulky.

That's odd. I don't remember seeing anything inside the sink when I arrived. Then again, situational awareness has never been my strong suit. Curious, I lift the sheets, but my discovery only raises more questions than it answers.

I pick up a round, golden pocket watch. It feels cold and heavy in my palm. Faint engravings trace the worn and chipped lid. I slowly pry it open, careful not to damage it any further. Cracks heavily mark the glass that covers the watch's face. Beneath my fractured reflection, I can see the word Elgin etched under the twelve. Probably a brand, but it doesn't ring a bell. Both hands are frozen at eleven o'clock sharp. Other than that, nothing else stands out, so I snap the lid shut and place the pocket watch back where it was.

Next to the pocket watch is a bulky, gray flip phone. God, I haven't seen one in years, and it's definitely showing its age. I pick it up to examine it further. Not a single scratch-free corner on this thing. I flip it open and start pressing a few buttons. No reaction. No light, no beep, only silence except for the faint creak of plastic under pressure.

An ear-shattering thunderclap catches me off guard. I almost drop the old thing. I tighten my grip on the flip phone and gaze outside. The wind has picked up, rain is pouring down more voraciously than before, and the outer and inner open window thrash back and forth, smashing against the wall. No wonder my papers took off. I've had enough fresh air anyway. It's time to focus, no more distractions. I gently place the flip phone beside the pocket watch. Neither are mine, and with the Info Desk already closed, I might as well leave them where I found them. I hurry to the window overlooking the courtyard and shut the outer one tight. Only the occasional howling wind and rain hammering the windows remain. The sky lights up, thunder rolls again, but this time low and distant, gently echoing through the empty Chem Lab.

I drag myself back to my desk and climb onto the chair, keeping it steady. As I put the analysis exercises in front of me, my phone lights up. Past midnight. I've been stuck on the same question for over an hour.

Should I give up and ask for help? Yara could probably help, but not right now. She's out cold by 9:30, like always. More importantly, she doesn't know how far behind I actually am. None of my friends do, and I want to keep it that way. It won't matter once I'm caught up again. Before ETH, I was always ahead of them, getting the best grades. Now I'm the one struggling. It's stupid, I know. I shouldn't be ashamed. But I am. What am I doing wrong? Maybe I'm not cut out for this-

My continuous spiraling stops when something snaps me back to reality. Someone turned the lights off. I spin around to face the switch behind me. It's only two steps away and right next to the entrance. I would've heard someone come in, wouldn't I? Was I that deep in thought? For a brief moment, I catch an odd sound beneath the rain. Thin, muffled, like something faintly corroding. Then it slips away. I leap off the chair, slam the light switch, and scan the room. Nothing.

No one's here.

Instead I catch a whiff of something. I sniff again, but it's already gone. Then again, I'm no stranger to unusual smells in this building. The earlier noise probably came from the storm raging outside. I turn back to my desk, where my phone catches my attention as it lights up.

1 am.

Did an hour just pass? Really? I haven't even done anything. I check again. There goes an hour I'll never get back. My lack of sleep is catching up with me, but I'll push through this one question and call it a night. I get on the chair once again. My newfound resolve gets shattered the moment I hear a loud thud. My blood runs cold.

This wasn't from the outside. I push myself off my wobble stool and stomp through the lab, heart pounding, scanning row after row. My clenched fists are slick with sweat. Heat rushes to my cheeks. Finally, in the last row, I find it and exhale all the air I have been holding in. A fallen wobble stool. Figures. It probably slipped from being in an unstable position. Now I feel stupid for freaking out like that.
I walk back to my workstation. With each passing row, a foreboding feeling wells up inside me. What time is it? My pace quickens, and by the time I reach my workstation, I'm running. I check the time.

2 am.

No, no, no, this can't be right. What the fuck is going on? There's no way another hour has gone by, no way I spaced out for so long. My eyes instinctively wander to that damn question. Not a lick of progress. How can I not solve one fucking question, how am I going to pass this exam, let alone graduate, I'm going to fail again, fall behind even further, never catch up to my friends-

No, forget the stupid question. How the hell is time passing so fast? It doesn't make any sense. Then I hear it again.

Like metal scraping on metal. I pause. No, it's more akin to acid eating away at metal. Then the strange smell returns, stinging at the edge of my nose. I draw in another breath, trying to place it, but the odor sharpens at once, the pungent, sulfuric stench spreads from my nose to my throat, making me retch uncontrollably. I cover my mouth and nose. Tears blur my vision, I can't see, the sensation of a thousand ants crawling under my skin spreads across my hands, my ears ring from the sizzling, tearing, never-ending noise, it's everywhere at once, my chest tightens, my lungs refuse to expand any further, it's never enough. I can't breathe.

Air. I need air!

I bolt towards the window, blocking everything else out, and yank it open. A cold gust of wind slaps me in the face, cutting through the fog in my head. I shakily adjust my glasses, take deep breaths, welcoming the cold, fresh air into my lungs. My body refuses to stop shaking, and my mind keeps racing. What should I do? The Chem Lab is once again filled with the sound of howling wind, splattering rain, and nothing else. Too terrified to look back, I scan the courtyard instead but stop when I notice something. I hold out my hand and wait for a raindrop. I lean out the window even further and wait again.

It's not raining anymore.

I slowly turn back towards the interior of the Chem Lab. No smell, no sound.

Empty.

Silent.

Except for the sound I thought was the storm.

It doesn't even matter at this point. I need to get out of here. I take one step after the other, expecting something to jump out from the corner of my eye at any moment. I reach my desk, only three steps left. A sound emerges from the sink.

Low.

Distorted.

Wet.

I recoil, ready to bolt. My foot snags on my backpack's shoulder straps and I trip headfirst towards the sink. I feel something cold in my hand. The flip phone. Its cracked screen glows.

3 am

A droplet hits my head. I look to the side.

The faucet.

Ah. Of course. How could I be so stupid. That was it.

The sound.

The smell.

The murmur.

Closer.

The heavy door lets out a clicking sound. I lean my body against it, opening it wide enough for my friend and me to enter.
"What's the point of waking up early to study when you're too tired for it?"
"That's what coffee is for. Besides, when did you go to sleep yesterday, hmm?"
"Shut up, Yara. Not everyone's got their shit together like you do."
"Excuses, you'll thank me later."
We reach the entrance of the Chem Lab.
"Look, someone's even earlier than us." Stella looks around. "Maybe they stepped out for a break?"
"Wait… that's Lukas's backpack."

EaST

How to Test a Nuclear Weapon and Get Away With It

There is a very curious fact about nuclear weapons: the weapon tests of new nuclear powers almost always work on first try. This is, all in all, surprising, as even the slightest design error can lead to a weapon "fizzling out"[1] instead of properly exploding, and there has not been a device in world history (and especially not one as technically involved as a nuclear weapon) that has worked on first try. But still, we know that this is the case for nuclear weapons, as the IAEA[2] has a network of highly sensitive detectors all around the globe capable of detecting any attempt at a nuclear weapons test, no matter if it worked or fizzled out.

This raises the question: how were these weapons actually tested and how did they get away with it?

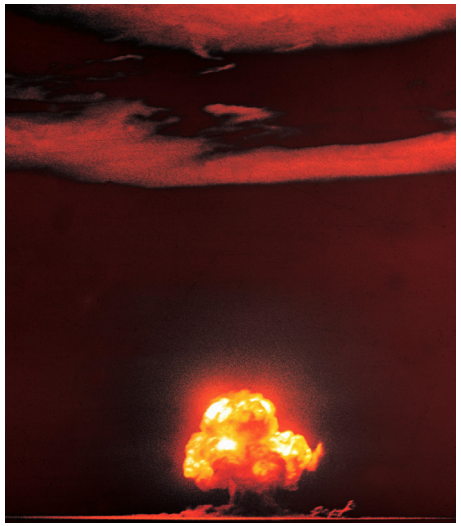


Figure 1: Boom.

To answer these questions, we'll first have a short look at how a nuclear weapon works, then discuss what aspects of the weapon need testing and why and finally how to perform the test and interpret the results.

[1]This is actually the proper terminology for a nuclear weapon that ignites too early.

[2]International Atomic Energy Agency

The fundamental idea presented in this article comes from the book *Nukleare Sprengkörper* by Prof. Seifritz, a former chair of nuclear engineering here at ETH, but as the book only shortly mentions the idea, I had to do the necessary calculations myself. I'm too lazy to properly quote everything, so here's some further reading[3] (any fact stated in the article can be checked against one of them):

- *Physics of Nuclear Explosive Devices* by Dalton E. Girão and Barroso
- *The Physical Principles of Thermonuclear Explosives, Inertial Confinement Fusion and the quest for fourth generation nuclear weapons* by Andre Gsponer and Jean-Pierre Hurni

If someone finds an error in the article, he gets a beer or coffee.

How does a Nuclear Weapon Work?

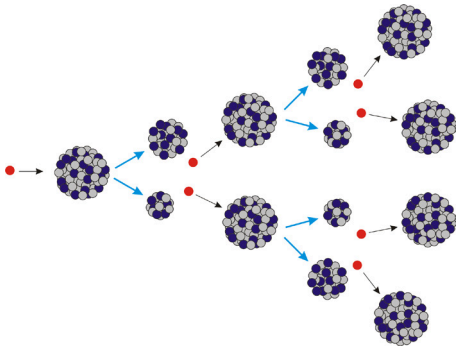


Figure 2: A chain reaction. You probably all remember this picture from physics class.

The process that makes nuclear bombs work[4] is *nuclear fission*, where an atom absorbs a neutron, causing it to split and release a truly gargantuan amount of energy[5] alongside some more neutrons. These new neutrons then fly away and break apart other atoms, releasing even more neutrons and energy. This process is (for obvious reasons) called a chain reaction. Not every atom or, to be more precise, isotope can be broken apart that way, though, and we have to look at the very end of the periodic table to find isotopes that are unstable enough to break apart when they absorb a neutron. One of the two naturally occuring isotopes of uranium has this property, namely U-235[6], while its cousin (as will become very important later) U-238 is rather stable.

[3]*Nukleare Sprengkörper* is available on libgen, sadly, the others are not.

[4]At least those of the fission variety.

[5]Approximately 200MeV. In comparsion, the highest energy chemical reactions produce only 10eV (!)

During a chain reaction, not all neutrons cause fission, though. Some are lost because they simply fly out of the assembly, and some are absorbed inside of the U-238 or the U-235. The probability that a neutron is absorbed or causes fission is measured in a quantity called the cross section Σ (Σ_a for absorption and Σ_f for fission).

Mathematically, the most important property of a chain reaction is called the multiplication factor k, which is the number of new neutrons generated per neutron. A k of 1 means that the reaction is stable (in nuclear-speak "critical"), while a $k > 1$ causes the number of neutrons and hence the power to increase (this state is called "supercritical"), while a $k < 1$ causes the power to decrease ("subcritical").

What Needs Testing?

For an assembled nuclear weapon, the yield Y (the energy released) goes roughly with the third power of the achieved overcriticality at ignition (Equation 1), so the aim of a nuclear weapon designer is to build a system whose criticality increases as much as possible in as little time as possible[7].

$$Y \propto (k-1)^3 \tag{1}$$

This is achieved by designing the weapon as a hollow sphere, which can be compressed using conventional explosives. **In the design and production process of the hollow sphere and the explosives surrounding it lies the core difficulty in designing weapons,** as the slightest error in the shock wave causes exponentially growing disturbances in the surface of the collapsing sphere[8], reducing the maximum overcriticality and thereby the yield[9]. This is especially a problem as we need to generate a concave shockwave, which is very much not the shape shockwaves are usually found in, so some cleverness is needed.

[6]This is uranium with enough neutrons in the core such that its weight is 235u

[7]The time needs to be as short as possible to prevent the possibility of an early ignition of the chain reaction caused by a stray neutron. Even in uranium bombs, where the background neutron radiation is very low, this can become a problem.

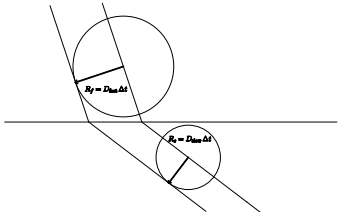


Figure 3: Snell's law for explosives.

The basic idea behind the design is the following: if we take two explosives with very different propagation velocities and put them next to one another, a detonation front travelling at an angle to the boundary will be diffracted at the boundary according to Snell's law (see Figure 3). But this means that we can design lenses the same way we do in optics!

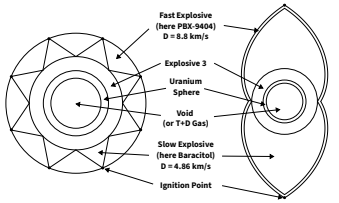


Figure 4: Example designs of nuclear weapons. The left one resembles the weapon build for the Trinity Test.[10]

[8]For those interested, the instabilities here are Reynolds-Taylor followed by Helmholtz.

[9]The careful reader will notice that we have skipped quite a few steps here. The answers for why the maximally achieved compression is so critical for the design might become clear in the next chapter.

[10]The shape of the lines on the right is called a logarithmic spiral, and generates the concave shockwave needed 👉

By using optics designed this way, we can create this concave shockwave. Examples of how realistic designs look can be found in Figure 4.

The central part to understanding how well a nuclear weapon will work is how evenly the sphere is collapsed and thereby what the maximally reached overcriticality will be.

How Do We Test It?

The test procedure is the following:

1. Build the weapon as usual, but replace large parts of the U-235 with U-238.
2. "Ignite" the weapon while shining a strong neutron source on it and measuring the resulting neutrons.
3. Calculate what the criticality with highly enriched uranium would have been

As the fissile U-235 in the weapon has largely been replaced by the chemically and thermodynamically almost identical U-238, it will remain subcritical the entire time but otherwise behave exactly the same.

Subcritical Multiplication Assemblies

The first task is now to understand how subcritical assemblies react to neutron irradiation[11]. If we imagine we have a single neutron in the assembly, it will, on average, produce $k < 1$ neutrons in the next generation. This means that after two generations, we expect to have k^2 neutrons, after three k^3 and so on. The total number of neutrons for each neutron produced will thus be

$$\sum_{n=0}^{\infty} k^n = \frac{1}{1-k} \tag{2}$$

The neutron response coming from the assembly when shone on with a neutron source emitting $\dot{n}$ neutrons per second will be proportional to $\frac{\dot{n}}{1-k}$, which allows us to continuely monitor the criticality of the assembly during the collapse.

Extrapolating the Results

The next question is how to extrapolate the result. I tried to stay away from any differential equations, but I have never seen this exact derivation anywhere, so I'll give it here in full. We start with the neutron diffusion equation

$$-\nabla \cdot (D\nabla\phi) + \Sigma_a \phi = \frac{1}{k}\nu\Sigma_f\phi \tag{3}$$

where ϕ is the neutron flux (a measure of the neutron density), D is the diffusion coefficient for neutrons (a measure for how quickly they are dispersed in the material), ν is the number of neutrons born per fission and ∇ is the Nabla operator.

The local cross-sections appearing in the neutron transport equation need to be scaled by the local compression ratio κ, giving

$$\begin{aligned}\Sigma_a(x) &= \kappa(x)\Sigma_{a0}\\ \Sigma_f(x) &= \kappa(x)\Sigma_{f0}\end{aligned} \tag{4}$$

and, as the diffusion coefficient scales with the reciprocal compression

$$D(x) = \frac{1}{\kappa(x)}D_0 \tag{5}$$

Inserting into the neutron transport equation (and dividing by $\kappa(x)$) gives

$$\begin{aligned}-D_0\left(\frac{1}{\kappa}\nabla\cdot\left(\frac{1}{\kappa}\nabla\phi\right)\right) + \Sigma_{a0}\phi\\ = \frac{1}{k}\nu\Sigma_{f0}\phi\end{aligned} \tag{6}$$

Importantly,

$$\frac{1}{\kappa}\nabla\cdot\frac{1}{\kappa}\nabla f = Af \tag{7}$$

is a linear operator and can therefore[12] be expanded in terms of its eigenfunctions. We are only interested in the smallest eigenvalue, though, as it will later dominate the power output of the weapon. Writing the lower eigenfunction as ψ and its associated eigenvalue[13] as $-\lambda^2$, we get

$$-D_0 A\psi + \Sigma_{a0}\psi = \frac{1}{k}\nu\Sigma_{f0}\psi \tag{8}$$

or, using the fact that $A\psi = -\lambda^2\psi$

$$D_0\lambda^2\psi + \Sigma_{a0}\psi = \frac{1}{k}\nu\Sigma_{f0}\psi \tag{9}$$

Note that we in general know nothing about how ψ (or even the domain on which it is defined) looks, but we do know that it exists and has an eigenvalue, which turns out to be enough. It should also be emphasised that this quantity does not depend on the cross sections — i.e., the mixture of isotopes used — but is purely geometric. Rearranging the above equation gives

$$\left(D_0\lambda^2 + \Sigma_{a0} - \frac{1}{k}\nu\Sigma_{f0}\right)\psi = 0 \tag{10}$$

Now, as $\psi(x) \neq 0$ in general,

$$D_0\lambda^2 + \Sigma_{a0} - \frac{1}{k}\nu\Sigma_{f0} = 0 \tag{11}$$

Solving this for k gives

$$k = \frac{\nu\Sigma_{f0}}{\Sigma_{a0} + D_0\lambda^2} \tag{12}$$

With this, we are done. By running the experiment described above, we can measure k by exploiting the properties of subcritical multiplication assemblies[14], and from this single measurement, we can calculate λ. This λ, as emphasised before, depends only on geometric properties and not the cross sections, it will be the same for the test we've done and the real bomb. Once we know it, we can calculate what k would be for the cross section of the original nuclear weapon with fully-enriched uranium.

Conclusion

The procedure we've developed only works for the most basic nuclear weapons type, but the weapons can get much more fancy. Replacing U-235 with Pu-239 (not Pu-240!) gives a higher ν and thereby higher achievable overcriticalities, replacing the void in the middle of the hollow sphere with a mixture of deuterium and tritium allows one to get rid of the nasty $(k-1)^3$ dependence, and the bigger weapons, called hydrogen or FFF-bombs[15], use a completely different setup alltogether (though they still use a normal nuclear weapon as an igniter), but all of this will have to wait for another article.

I think all that remains to say is "You're welcome" to the people for whom this information is of use.

For a world with more ✨fireworks✨!

for compression. Parameterised in polar coordinates, if $\eta = \frac{D_{\text{slow}}}{D_{\text{fast}}}$ is the ratio of detonation velocities, then $r(\theta) = R\exp\left(\frac{\eta\theta}{\sqrt{1-\eta^2}}\right)$.

[11] We'll oversimplify a bit here, but the basic concept is sound.

[12] I know, I know, but in this case it's true. The spectrum is also nice and discrete.

[13] This eigenvalue is closely related, though not equal, to the quantity known in nuclear engineering as "Geometric Buckling".

[14] We have to make sure to mostly excite the fundamental mode with our neutron source, which can be a bit tricky.

[15] Fission, Fusion, Fission.

Connections

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https://connections.swellgarfo.com/
Make your own connections and submit it to visionen@vis.ethz.ch. The connections creator is done with ETH, hence, somebody else needs to do it.

*****@cyberfy.ch

01001011 01101110 01101111 01110111 01101100 01100101
01100100 01100111 01100101 00100000 01101001 01101110
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Writing is awesome

JOHAN STETTLER - VISIONEN MEMBER FROM 2019 TO 2025

It is kinda sad about this being my final article for VISIONEN. Not that I dislike writing or the magazine, but after 9 years here at ETH, I've finally earned my Master's degree (in side questing and avoiding responsibilities, of course). VIS always struggles to find new people. But I've often wondered why more people aren't eager to write or contribute to the VISIONEN. It's genuinely awesome: not too much work, and it helps you hone your writing skills, which is incredibly useful. My writing has noticeably improved, benefiting my thesis, work emails, and various reports at my job. I think writing is a skill anybody needs. What are you waiting for? Use this opportunity. Join VISIONEN!

Data Management Systems (n = 10)	1	2	3	4	5	Did not Take
Disk Math	3	3	4	0	0	0
Lin Alg	3	3	3	1	0	0
A&D	0	3	3	3	1	0
E. Prog	0	1	3	3	2	1
A&W	0	3	6	1	0	0
DDCA	2	2	1	3	1	1
Anaylsis 1&2	7	2	1	0	0	0
P. Prog	0	0	1	3	6	0
Theoretical Computer Science	7	0	2	1	0	0
SPCA	0	0	2	2	6	0
NumCS	3	4	2	0	0	1
Networks	0	0	4	1	5	0
DMDB	0	0	0	4	6	0
FMFP	3	6	1	0	0	0
Statistics	2	4	2	0	0	2
Compiler Design	0	2	3	0	2	3
Visual Computing	7	1	0	0	0	2
Computer Systems	0	1	1	2	5	1
APC	1	1	1	0	0	7
Intro to Information Securtiy	1	1	1	1	0	6
Intro to Machine Learning	5	3	0	0	0	2
Rigorous Software Engeneering	1	3	2	1	0	3

Machine Intelligence (n = 20)	1	2	3	4	5	Did not Take
Disk Math	5	6	5	3	1	0
Lin Alg	0	0	0	4	16	0
A&D	2	3	5	2	8	0
E. Prog	4	0	7	4	5	0
A&W	0	5	5	1	9	0
DDCA	13	5	0	0	0	2
Anaylsis 1&2	0	0	4	5	10	1
P. Prog	7	4	5	2	2	0
Theoretical Computer Science	7	8	2	3	0	0
SPCA	8	6	5	0	1	0
NumCS	2	4	5	3	6	0
Networks	13	3	2	2	0	0
DMDB	6	7	4	1	2	0
FMFP	11	6	1	2	0	0
Statistics	0	0	1	3	16	0
Compiler Design	7	1	0	0	0	12
Visual Computing	2	2	2	10	2	2
Computer Systems	6	8	1	0	1	4
APC	3	1	5	2	0	9
Intro to Information Securtiy	9	3	0	1	0	7
Intro to Machine Learning	0	0	0	3	17	0
Rigorous Software Engeneering	5	4	1	1	0	9

Secure and Reliable Systems (n = 23)	1	2	3	4	5	Did not Take
Disk Math	0	0	5	12	6	0
Lin Alg	7	7	7	2	0	0
A&D	1	5	9	5	3	0
E. Prog	4	0	8	5	6	0
A&W	1	6	9	5	2	0
DDCA	3	3	6	5	1	5
Anaylsis 1&2	10	9	3	1	0	0
P. Prog	3	7	6	5	2	0
Theoretical Computer Science	3	3	9	7	1	0
SPCA	1	0	6	7	8	1
NumCS	11	7	4	1	0	0
Networks	0	0	7	9	7	0
DMDB	10	6	5	2	0	0
FMFP	4	3	5	6	5	0
Statistics	2	11	7	2	0	1
Compiler Design	4	4	5	5	3	2
Visual Computing	15	2	0	0	0	6
Computer Systems	0	3	7	6	5	2
APC	2	5	3	0	0	13
Intro to Information Securtiy	0	0	1	6	12	4
Intro to Machine Learning	11	6	2	0	0	4
Rigorous Software Engeneering	2	4	3	8	1	5

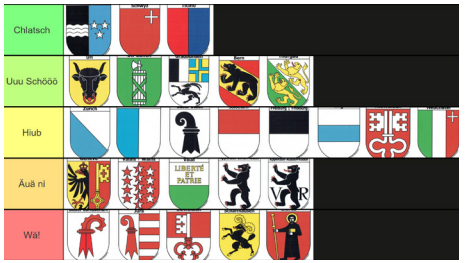
You do not have something to write about?

Bullshit. Sure, VISIONEN is the official magazine of the Computer Science Student Association, but it doesn't mean we have high standards. We print everything, even the most stupid shit. That's the beauty of it. It's a platform where you can be creative and experiment with a low bar.

Give some tips for new students, what courses are fun, and which should be avoided. I once did a survey showing what might be the best master's direction based on your preferred bachelor courses. Write about the best ASVZ offerings or the best places to visit in Zürich. Just share anything from your perspective as a CS student at ETH.

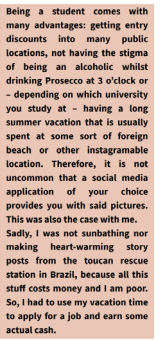
Or write about your hobbies or interests. I've written reviews on board games and movies, while others have shared climbing experiences or their favourite recipes. I bet you do have a strange opinion on anything. You are a nerd, after all. I bet there is something stupid you can overanalyse. We did featured articles about what the best coat of arms is of Switzerland, what everyone's favourite pen is, or how to use a condom. There was even a very passionate solitaire tier list.

See more in VISIONEN 2023/4 👉



Paren't - Do you know how to use a condom correctly?

JOHAN STETTLER - FATHER OF 0. ...AS FAR AS I KNOW



You think nobody will read it?

I was quite astonished by how many people in the common room talked about my articles. Sure, sometimes they made fun of them, but I also got some nice compliments—even from people who weren't my friends (or my mom). You'd be surprised how many people actually read them. Maybe not hundreds, but some.

But you don't write for others. You write for yourself. My writing has certainly improved. You can check all my old articles—they were super embarrassing back then, full of grammatical errors, and with no clear narrative. Compare my article here with any other in this issue. You'll notice the difference. My sentences are short, on point and concise. The article is better structured. It contains only a few sentences that are redundant or random, which don't really contribute to the article at all. Not to criticize my fellow writers here, but that's the difference experience makes. This should be an encouragement to keep on writing. I am the proof of everyone can improve.

Sure, you can use ChatGPT, but it alone won't get you far. If you're not good at expressing yourself in written form, ChatGPT might not fully understand your intentions. It can produce a movie review, but it might not emphasize specific points or criticisms you want to highlight. It certainly won't capture your humour. In my experience, ChatGPT is a great assistant, but you still have to structure the article and choosing the right words by yourself. This needs practice. This skill transfers to email writing, reports, documentation and much more. That is why you should write on a regular basis.

You do not have time?

You get faster at writing. Most articles I worked on took me about a day. The longest one was the survey I conducted, which took around four days of work spread over three weeks. It really doesn't require much effort unless you're writing an article involving a lot of background research. Even then, you can probably manage it in five days

spread over four to five weeks.

You think the deadlines are stressful?

We publish six times a year. If you miss a deadline, your article will simply go into the next issue—so don't worry too much about it. Just write when you have time or feel inspired. I never cared about deadlines; I just wrote whenever I felt like it—or as a way to procrastinate.

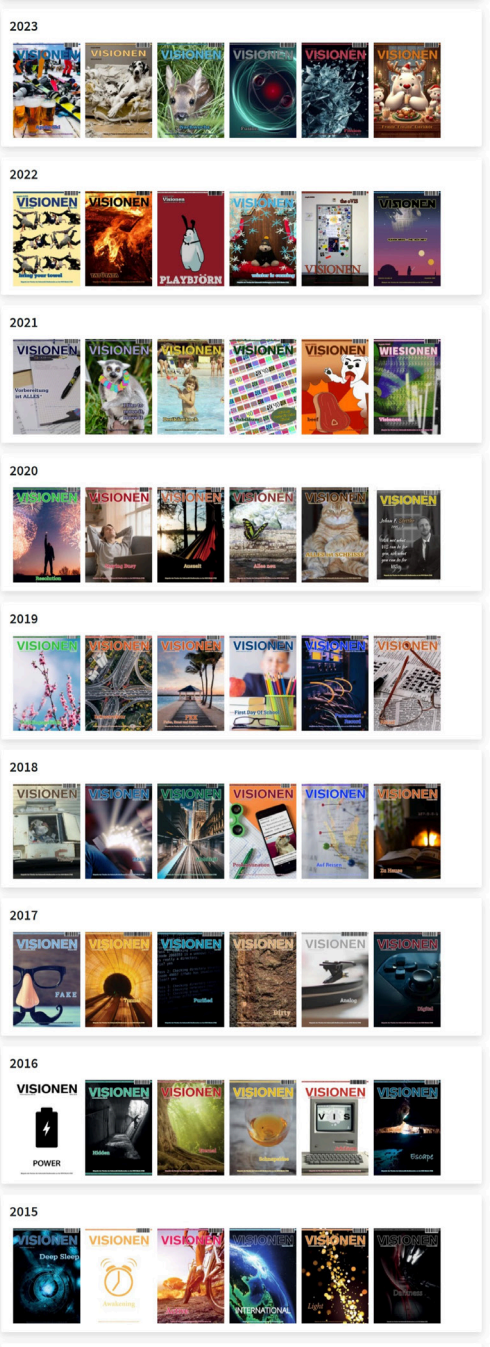
You really hate writing?

Gee, then do something else! Make puzzles, riddles, or memes—VISIONEN needs anything. I also worked on the layout for a while. There are so many ways to be creative. We're also always in the need for cover pictures!

I hope I've convinced you to join VISIONEN starting your career as a writer. Thank you, VIS, for the awesome time, the experiences, especially for this cool opportunity to write and publish my ridiculous opinions.

P.S. Someone please update the cover of issue 2020/6 with 1995–2025. Thanks!

All VISIONEN issues ever made!



Solution to Connections

SMILEY MOUTH
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COMMON WINDOWS DIRVES
C, D, H, Z

(DE)REF
&, *, ->, .

USED FOR COMMENTS
!, #, %, --

v.l.n.r. Oben: Jonas Blank, Yulia Avilova, Benjamin Gruzman, Hüseyin Deniz
Mitte: Nicolas Wehrli, Mikail Gedik, Cédric Girardin, Yannick Hinnen, Kiara Chau Garcia, Basil Feitknecht, Selin Nayki
Vorne: Hannah Osswald, Franziska Schneider, Martin Shen, Wanglei Shen, Alexis Elisseeff, Joshua Durrant, Selina Turhan
Nicht anwesend: Andrew Lee, Ebruli Dogan, Fiona Pichler, Florence Kissling, Johan Stettler, Kamelia Ivanova, Kata Tóth, Pascal Strebel, Stefano Lanza

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Infos, wie du einen Artikel schreiben kannst, findest du unter https://visionen.vis.ethz.ch

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Benjamin Gruzman
chefredaktion@vis.ethz.ch

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Kata Tóth

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Benjamin Gruzman
Kata Tóth
layout@vis.ethz.ch

Inserate
Franziska Schneider
inserate@vis.ethz.ch

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VISIONEN Team
Yulia Avilova
Stefano Lanza
Kata Tóth
Mikail Gedik
Johan Stettler
Ebruli Dogan
Florence Kissling
Hannah Osswald
Pascal Strebel
Selina Turhan
Wanglei Shen
Hüseyin Deniz
Fiona Pichler
Alexis Elisseeff
Jonas Blank
Franziska Schneider
Joshua Durrant
Kamelia Ivanova
Johan Stettler
Andrew Lee

visionen@vis.ethz.ch

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