A guide for a smooth project

You will find in this guide information and suggestions we gathered over the years to make your project journey a bit smoother. We wrote this document intending to share some of the best practices we adopt in our group, and hopefully, you will find them valuable and start embracing it as well. Some aspects are mandatory, but much of the document gives guidelines that you can choose whether appropriate to follow in your case. Please also refer to the official guidelines that you can find under:

- Master thesis: https://sti.epfl.ch/smt/master-projects-guidelines/
- Semester projects: https://sti.epfl.ch/smt/smt-semester-project-guidelines/

1 What can you expect from us?

We know that students are juggling many balls (i.e., taking many courses), but don't worry, you have nothing less than our full support. This support includes all the necessary facilities, equipment, and materials required to complete your project successfully. If you feel something is missing or slowing you down, just ask, and we will do our best to solve it.

We will also have weekly meetings to clarify questions, discuss ideas, plan experiments, and adjust the project whenever necessary.

You are also welcome to address us with questions not directly related to your project. Try to take advantage of the access you will have to a research lab to meet new people and learn new things.

2 What do we expect from you?

Keep in mind that you will be doing relevant and state of the art research. Your project was thought carefully and involved many hours of preparation from Professors, post-docs, teaching assistants, and lab personnel. We plan the size and objectives of your project based on EPFL rules, which foresees considerable dedication (10 ECTS for semester projects and 30 ECTS for masters' projects). Therefore, we expect you to work around 20 h/week. No one will check this, but the student effort inevitably reflects in the produced work, which is taken into account when grading the projects.

Experimental work is intensive! Try to speed things from the very beginning. Your future self will be glad you did it. Usually, after the mid-semester presentation, things get complicated! Projects from other classes will start to fall on your lap, and reports, exams, and presentations will pile-up. (No, this semester will be no different! Yes, we are sure). The fun part of the project can fade away quite fast if you need to perform experiments close to other deadlines.

3 Your first week

As soon as you know your class schedules, contact your assistants to find a fixed weekly hour for the regular meetings.

Also:

- Be sure to register your project at IS-Academia
- Ask us for the "Project Proposal" to be signed (by the Professor)
- After your first meeting discussion, you will have some studies to do and prepare a plan on how to divide your project tasks (discussed in the meeting) and the duration for each one.
    - Put this plan in a GANTT chart format.
    - Add to the plans: report delivery dates, presentation dates, and the time for writing reports, preparing presentations and implementing report revisions from reviewers.
    - Send the plan to your supervisors by the end of the second week.
    - We will use the plan you did to follow your progress.
- If you are going to use lab space, we will give you a key. A CHF 50 deposit for the key should be made and you will have it back when the key is returned at the end of the project.

4 The end of the project

What happens at the end?

- You submit a report
- You make a final presentation
- You should also submit files:
    - from your development work (the final versions) including enough documentation to compile or re-run code or analysis
    - The source for your final report and final presentation
- You should return your key (if you had a lab space)
- You should return all physical materials that are the property of the lab

5 Presentations

One of the semester project objectives is to give students practice at presenting to a technical audience and improve their presentation skills. On two occasions you will present your project to members of Prof. Francesco Mondada's lab and other invited experts.

The mid-semester presentation, where you will have 10 minutes to present the evolution of your work and how well you were able to follow the planned tasks, and 10 minutes for questions/discussion. Although the mid-semester presentation is not graded, it is a critical opportunity to receive valuable feedback on your work. This feedback is instrumental in guiding the remainder of your project and serves as an excellent preparation for the final presentation. A

second, and final, presentation will be held at the end of the semester, where you will have 20 minutes to present your project and results followed by 10 minutes for questions (20 minutes for master thesis).

5.1 Audience

Your target audience is an EPF engineer who does not have in-depth knowledge of the specific field of your project. For Master projects, the audience of your final presentation will also include an external expert (from another lab of EPFL, a company or similar, to suit your project).

5.2 Rehearsals

You might wonder, why rehearse? How can I not know everything about the project? I've been working day and night for the last few months... Well, exactly because of the amount of work you will have done, you should practice your presentation. It is quite common to extrapolate the limited time because you have too much to say in too little time. You will be asked to do at least one rehearsal session before each presentation (mid and final).

Try to schedule the rehearsal, with your supervisors, with some days (one week?) before the official presentation, so you could have enough time to make the recommended adjustments. And, maybe practice once more.

Stick to the rules! You will not be allowed to extend your presentation over the time limit.

5.3 Slides (and how to avoid using PowerPoint as a torturing instrument)

Well, again, this is a vast topic. You can find many books and materials on the subject. But let us give you some short and simple suggestions:

- Just one message per slide.
- Avoid too much text. It makes your presentation confusing and hard to follow. Should I, as an observer, read the slide or listen to you?
- Avoid too many items on a single slide. Too many elements will require excessive cognitive effort and, consequently, loss of attention.
- Avoid too many colors. And, when decided which to use, maintain the style throughout the presentation. Watch out for low-contrasting colors (like yellow on a white background).
- People are attracted by moving objects, high-contrast and signaling colors (red, orange), and big things. If you don’t want people to divert their attention from you, avoid those.

The following slides show the difference between a bad and a good one. The images were extracted from the excellent document "Traditions, templates, and group leaders - Barriers to effective communication" by Jean-luc Doumont. The transformation process required to remove the clutter from slides is non-trivial. Do not underestimate the amount of work required to get a

"clean" presentation.

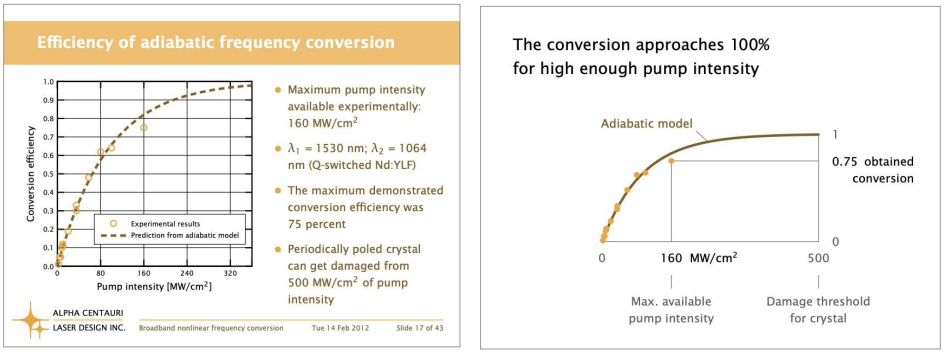

Fig 1. Example of bad and good (clean) slide.

6 Grading

After the final presentation, the Professor, supervisors, and lab members will discuss, privately, the quality of the presented work (including the student commitment, the quality of written reports, and the oral presentation), and agree on the student's final grade. Below you will find a list of subjects that matter to us when we grade your work:

- Report
  - Structure, presentation
  - Clarity
  - Completeness

- Work in the lab
  - Involvement to the project
  - Quality of results
  - Theory, state of the art, understanding
  - Organization, working methods, documentation
  - Creativity, autonomy
  - Communication with the team

- Oral presentation
  - Clarity of the objectives
  - Quality of the presentation
  - Focus on main points
  - Oral expression, reply to questions

7 Proposed workflow

No matter who you ask, people will always have different strategies to document findings during the research process.

But we would like to give you some suggestions:

a. Have a lab notebook when doing experiments or research activities. Don't trust your

working memory too much. Always note down dates and never remove pages, even the ones with wrong or invalid data. Just cross them out. Note that the millenary art of keeping a science journal is slowly fading away and being replaced by Electronic Lab Notebooks.

b. Life fact: you will write a lot. It doesn't matter if you will spend your professional career in academia or industry. Hence, part of your project objectives is to make you exercise the difficult art of writing.

   When writing your reports, we would like to suggest the following approach:

   - Create the first draft using **gDocs**. The quality of the document is not excellent, but it has reasonably good sharing and reviewing tools.
   - After your document was reviewed, you could move it to LaTeX to exploit its typesetting capabilities to create beautiful documents. For easy installation and the ability to share your documents, we recommend the online tool **Overleaf**.
   - Once finished, export a **PDF** file.

c. Use a literature tracking system. We recommend **Zotero**, which is free and has a nice integration plugin with google docs. But there are other options like Mendeley...

d. The number of sad stories of people losing life-long data is endless. For the backup naïve, we could recommend:

   - Continuous backup using the Google Drive app.
   - Mandatory: storing code on online repositories (Github, GitLab, etc.).
   - Safety backup, especially for huge chunks of data (e.g., videos, photos), use a good and reliable SSD HD (Samsung T5 or T7 is fast and password protected) or a thumb drive.
   - When copying local data to an external drive or remote location, the `rsync` command can be handy for Mac and Linux users.
     ```
     $rsync -a --verbose origin_folder/ destination_folder
     ```

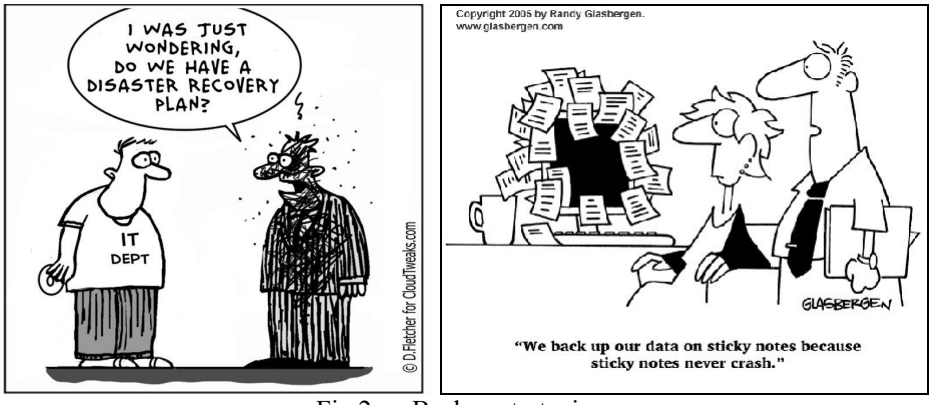

Fig 2. Backup strategies.

8 Sharpening your skills (before it's too late)

As mentioned before, you will spend a good deal of time writing a final report (required for every project), experimental results and presentation slides. We will not hold your hand on the writing process, but we can give you a strong push ;-) Starting here.

8.1 The report document

8.1.1 The basic structure

- **Cover**: All the things you are used to plus your picture and the names of the supervisors (Professor and assistants).
- **Project proposal**: when you start your project, you should have received a project proposal document where you and the supervisors need to sign it. Add it after the cover.
- **Body:** should comprise an introduction, chapters (with literature review, methodology, results, etc.), and a conclusion.
- **Post-textual elements**: Bibliography and, optionally, appendices.

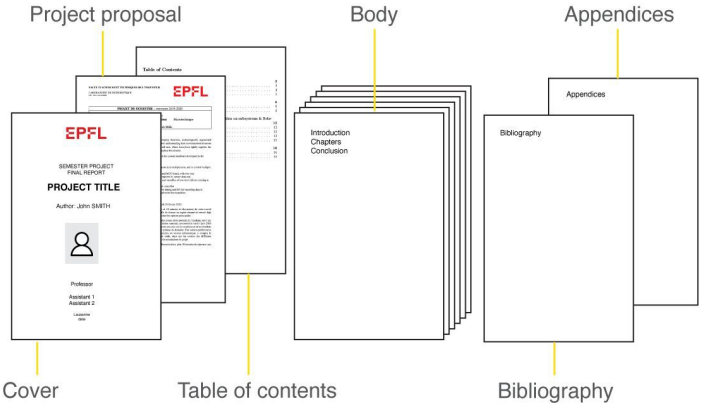

Fig 3. Structure of the report.

8.1.2 What font to use?

Specialists tell us that the decision between serif or non-serif fonts depends on the amount of the text (infinite number of references. Ok, here is one). But the rule of thumb is: whenever writing long texts (exceeding five paragraphs), go for typesets with serif. They are gentle to the eyes. Examples are Times New Roman, EB Garamond, Minion Pro, Libre Baskerville, ET Book, etc.

Fig 4. Difference between serif and sans-serif fonts.
Source: https://www.97thfloor.com/blog/serif-vs-sans-serif

8.2 Writing tips

8.2.1 Sentences and paragraphs sizes

Please, use punctuation. Long sentences are tough to read. If a sentence is longer than three lines, it should probably be fragmented. Also, try to be objective and not making subjective statements.

Sentences should contain one idea. And a paragraph works as a collection of sentences around similar ideas. If your paragraph is more than ten lines long, probably, it is too long.

8.2.2 Numbers, quantities, and uncertainties

For us, geeks, writing numbers is more natural than writing words, right? But, usually, we are not taught how to do it properly. Should it be $g = 9.81 \text{m/s}^2$ or 9.81 m/s^2 or 9.81 m s^{-2} ? If you add uncertainties to the value, the chaos reigns! The vast majority of engineers do not follow any standards on how to write values of quantities, even when we have one!

The Bureau International des Poids et Mesures wrote the "The International System of Units (SI)" (link), and the "GUM - Guide to the expression of uncertainty in measurement" (link). Although not everybody follows these guidelines, we do. The examples below were extracted from these sources.

8.2.3 Formatting the value of a quantity (and how not to do it)

Warning: two languages, two decimal separators: French (",") × English ("."). Since you will be writing in English, use decimal points. Ex.: $c_{\text{air}} = 331.3$ m/s ($c_{\text{air}} = 331{,}3$ m/s).

- "The numerical value always precedes the unit and a space is always used to separate the unit from the number." Ex.: $t = 25.0$ °C ($t = 25.0$°C). Exception for degrees: 360° (360 °)
- "If the number is between +1 and −1, then the decimal marker is always preceded by a zero." Ex.: −0.234 (−.234).
- "...numbers with many digits … may be divided into groups of three by a space, in order to facilitate reading. Neither dots nor commas are inserted in the spaces between groups of three." Ex.: 43 279.168 29 (43,279.168,29)
- Try to stick to SI units.
- Divisions can be indicated by a solidus "/" or by negative exponents. Ex., $k = 1.380\,649 \times 10^{-23}$ J/K or $\text{J}\cdot\text{K}^{-1}$
- Seconds are abbreviated as "s" and not "sec". Ex.: 10 s or 10 seconds (10 sec)

8.2.4 Reporting Uncertainty of a quantity

- "One convenient way to represent the standard uncertainty is given in the following example: $m_n = 1.674\,927\,471\,(21) \times 10^{-27}$ kg"
- "In reporting final results, it may sometimes be appropriate to round uncertainties up rather than to the nearest digit. For example, $u_c(y) = 10.47$ mΩ might be rounded up to 11 mΩ. However, common sense should prevail and a value such as $u(x_i) = 28.05$ kHz should be rounded down to 28 kHz. Output and input estimates should be rounded to be consistent with their uncertainties; for example, if $y = 10.057\,62$ Ω with $u_c(y) = 27$ mΩ, y should be rounded to 10.058 Ω. Correlation coefficients should be given with three-digit accuracy if their absolute values are near unity."
- Example on how to report an object with a nominal mass of 100 g:
    - $"m_S = 100.021\,47$ g"
    - $"m_S = 100.021\,47\,(35)$ g, where the number in parentheses is the numerical value of

(the combined standard uncertainty) u_c referred to the corresponding last digits of the quoted result."

- *"m_S = 100.021 47 (0.000 35) g, where the number in parentheses is the numerical value of (the combined standard uncertainty) u_c expressed in the unit of the quoted result."
- *"m_S = (100.021 47 ± 0.000 35) g, where the number following the symbol ± is the numerical value of (the combined standard uncertainty) u_c and not a confidence interval."

  "Note: The ± format should be avoided whenever possible because it has traditionally been used to indicate an interval corresponding to a high level of confidence and thus may be confused with expanded uncertainty."

When using Latex, we recommend the SIUNITX package to simplify how quantities should be written.

8.2.5 Spell checking and translation tools

There are many tools capable of doing a good check on your text. Use the following tools on your final text before submitting it to revision.

- Grammarly (has a plugin for gDocs), for English checking.
- DeepL, for translating.
- Humans!! Despite what your Machine Learning professor told you, we are still unbeatable in finding odd stuff.

8.3 Reviewing

When you send your document for revision by your supervisors, we check the document for many different aspects. For instance, we proof-read the document to avoid some small spelling and grammar errors (always present! Even after using high-tech tools), until more subjective matters like the coherence of the argumentation and the order it is presented (i.e., legibility, clarity, correctness, etc.). We also try to double-check all the numbers, data, graphs, and results. When time is on our side, we try to help with the document's overall aesthetics (e.g., graphs, formatting) and commenting on the writing style.

As you imagined, a thorough review process can easily take some days until you get our comments and suggestions for changes back to you. It is not uncommon to receive plenty of suggestions, and you should have planned to invest time changing the document (without forgetting that you probably have a presentation to prepare).

9 Plagiarism and self-plagiarism

No, not even one single sentence! If that sentence or quote is so perfect that you feel it must be part of your text, that's ok. Just add it between "quotes" and name the reference. In doubt, ask your supervisors, and together you will find a solution.

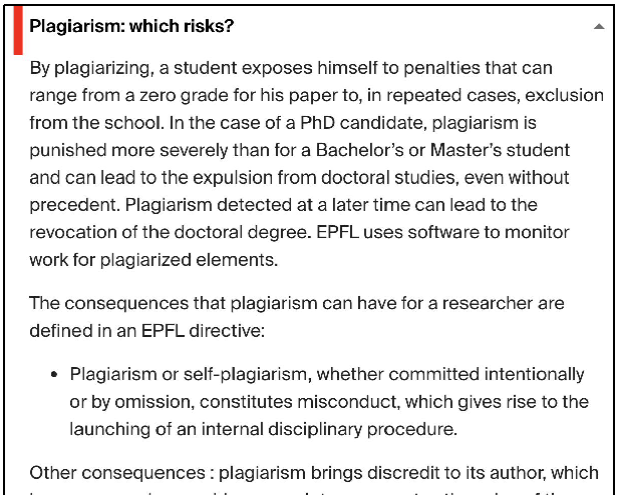

Fig 5. Plagiarism at EPFL, extracted from the EPFL rules.

Copying previous work you did, and depending on the case, can be considered self-plagiarism.

👀 We trust, but we also verify. EPFL uses automatic tools that make it virtually impossible to get away with it (iThenticate).

10 Effective graphical displays

10.1 Maximize data-ink

The data to ink ratio concept was forged by Edward Tufte, which has amazing books on the subject of data visualization (see references below). In his books, he defends, and we agree, that graphs should have high data to ink ratio in order to conceive a message efficiently. A high number means that most of the ink used to draw the graph is useful to represent the desired information.

$$\text{data to ink ratio} = \frac{\text{(data ink)}}{\text{(total ink used to print the graph)}}$$

The following example, from the book "The Visual Display of Quantitative Information" (1983), depicts two graphs. The left, with a data-ink ratio < 0.6, and the right with a data-ink ratio of 0.9. Which one do you prefer? Why?

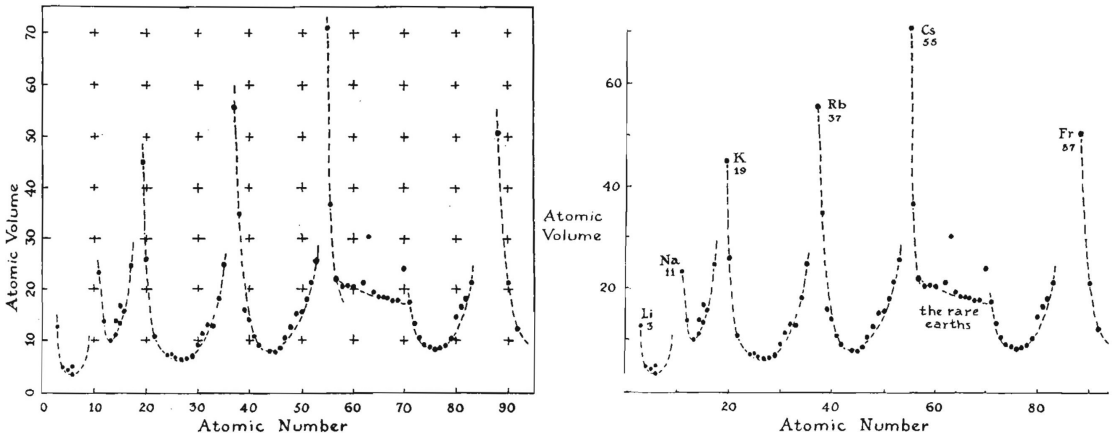

Fig 6. Examples of a bad and a good data to ink ratio.
Source: "The Visual Display of Quantitative Information" (1983)

10.2 Fonts for graphs

Use sans-serif ones like: Arial, Gill Sans, Helvetica Neue, Montserrat, Roboto.

Feeling bold? Decima Mono for tick labels (like in some graphs from fivethirtyeight.com)

10.3 Colors and palettes

You have two options: let your system (matplotlib?) decide for you which colors will be used on your plots, using the default style. Or, you can take control of the situation and use colors that are more meaningful and precise to your objectives. The subject of colors is vast, so we will let you explore it if you wish. Below, some tools that we use to help us to select color schemes.

Fact: did you know that ~9% of human males have some sort of color blindness (https://en.wikipedia.org/wiki/Color_blindness). If you present your project in a room with 30 people, probably ~3 attendees in your audience do not perceive the colors in the way you intended.

10.3.1 Tools for color palette (color maps) creation

http://tristen.ca/hcl-picker https://learnui.design/tools/data-color-picker.html#palette https://vis4.net/palettes

10.4 Three selected examples

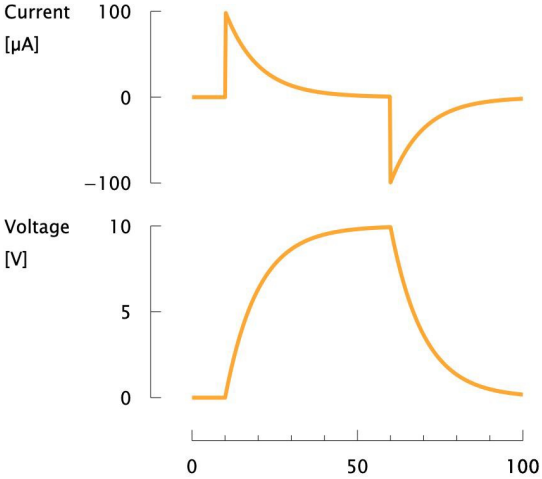

Fig 7. An easily understandable plot. All clutter (grid lines, unnecessary labels) was removed.
Source: https://principiae.be/pdfs/TUG-X-004-slideshow.pdf

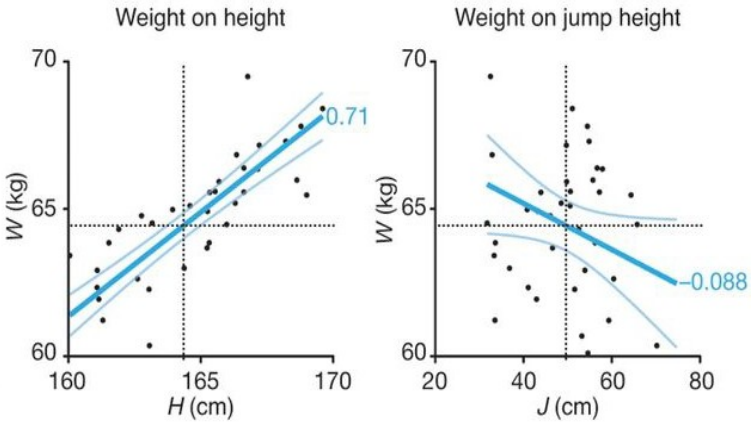

Fig 8. Data integrity through confidence intervals or error bars.
Source: https://www.nature.com/articles/nmeth.3665

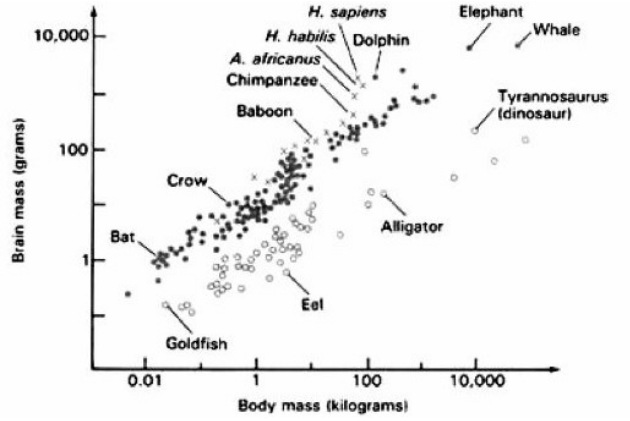

Fig 9. Good figures are self-explanatory.
Source: "The dragons of Eden" by Carl Sagan

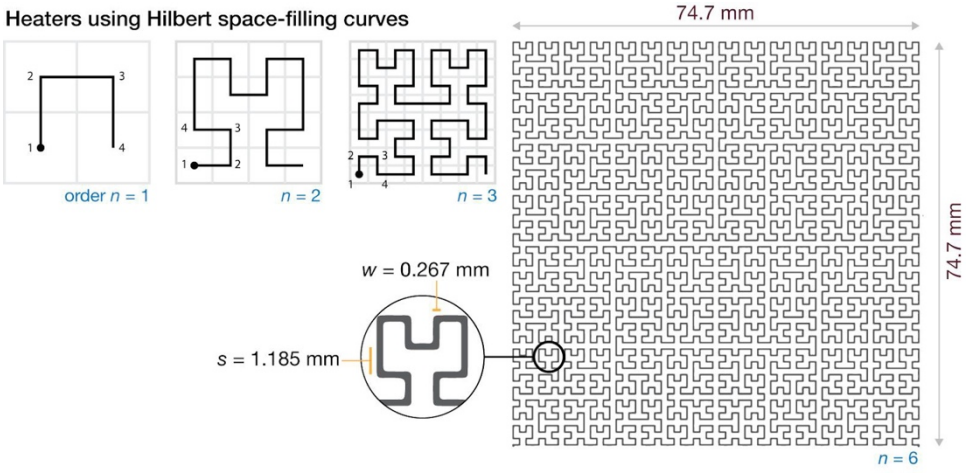

Fig 10. When trying to show something complex, go slow. Evolve a concept until reaching the desired result.
Source: EPFL / MOBOTS / Hiveopolis

11 Recommended references

Book: Trees, maps, and theorems - Effective communication for rational minds. By Jean-luc Doumont. Principiae, 2014.

Video: Choosing the right graph, by Jean-luc Doumont:
https://www.youtube.com/watch?v=6lm4wJ1qm0w

Video: "How to avoid death by PowerPoint" by JP Phillips
https://www.youtube.com/watch?v=Iwpi1Lm6dFo

Books by Edward Tufte:

- Beautiful Evidence
- The Visual Display of Quantitative Information
- Envisioning Information

Paper: Affective color in visualization, by Bartram et al. 2017
http://dx.doi.org/10.1145/3025453.3026041

Book: The Sense of Style: The Thinking Person's Guide to Writing in the 21st Century. By Steven Pinker, 2015.