Techniques for Scientific Writing and Associated Softwares

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December 4, 2018

Outline

Strategies for scientific writing

Discussion on the objectives to be achieved before the PhD defense

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- ▶ keep close contact with industrial needs
- ▶ great written and oral communication skills

The bad examples

Some countries/universities pressure researchers to success

- ▶ quantity favored over quality:
    - ▶ lots of non new results being published
    - ▶ original papers in conferences are very scarce
      ⇒ You end up only going for "All Star" sessions
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    - ▶ production of existing results from voluntary avoidance of literature review
    - ▶ production of clearly wrong results (at least 1/3 of submitted conference papers are wrong)
    - ▶ increased plagiarism!
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▶ a PhD thesis is very short: do not waste your time!

    ▶ Typical PhD work-time: from 8am to 6pm + book reading at night + work during weekends

    ▶ Reserve 6 months for PhD dissertation. Many advantages:

        ▶ you need to find a consistent outline for the dissertation (often work broken down in pieces)

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- ▶ the PhD student is "officially" only half-responsible of his success/failure
    - ▶ Students may forget they must work hard (a minimum work gives you your diploma)
    - ▶ Competition for job starts AFTER the PhD

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IMPORTANT ADVICE: Create your own webpage/Scholar account early on! And add a picture!

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Efficiently using conferences and journals

Convincing, taking position, and networking

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Equally valid within the lab: go to seminars of both senior and junior scientists! **Be curious!**

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▶ Never publish anything based on conjectures or proposing conjectures! Especially so if the conjecture is likely not to hold.

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General instructions for paper writing

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  - People often do not understand why these articles are rejected since they are correct.
    $\Rightarrow$ Scientific honesty must be accounted for here.

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- **Poor writing style/quality/English expression:** A paper with lots of missing words, spelling mistakes, etc. is automatically of poor quality. Strong rejection can be granted on these sole grounds.
  ⇒ Botching papers is unacceptable!

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- ▶ **Readers of long papers might get tired:** make sure long papers deserve to be so long! Overwriting a paper annoys readers who typically won't read the whole thing and ask for major revision if reviewers.

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$\rightarrow$ Results may be introduced in a separate "Main Results" section prior to the methods, especially in math papers. This avoids the main result to be found on page 53 and helps the reader to know where the paper is getting at.

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  → May be joined to discussion in a "Discussion and conclusions" section.
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- ► **References**:

The IMRAD format (2)

"Introduction, Method, Results, And Discussion"

- ▶ **Discussion**:
  1. **Interpret the results, don't READ them!**.
     - ⇒ This is often not done in papers and leads to botched work!
  2. Discuss the consequences for science, the new doors this opens, etc.
     - ⇒ This part may alone justify your work and the continuation of it!
- ▶ **Conclusion**:
  1. Restate the main results and the consequences of the discussion
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- ▶ **References**:
  1. list of all papers USED in the text
     - ⇒ Do not cite external sources not called in the text.
     - ⇒ Alphabetical ordering or appearance ordering.

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The title will be read by hundreds of people!

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- ▶ choose appropriate wording
    - ▶ avoid common uninformative/waste words, e.g. "use"
    - ▶ avoid all possible confusions, e.g. "ECG of a monkey using . . . " (who uses what?)
    - ▶ build titles that includes natural keywords!
      $\Rightarrow$ Some important information (e.g. practical application of the main math result) may never be spotted from Google.

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▶ Researchers are very sensitive to references:
  ▶ recall that H-index is the international evaluation of a researcher
  ▶ references acknowledge the work of people before you
  ▶ avoid open criticism of bad articles (do not reference them!)
  ▶ avoid criticism of old articles (your ideas often come from a new look to them)
  ▶ make an exhaustive analysis of the literature in order not to miss any actors
  ▶ when not referencing an article, make sure the paper excludes it naturally (reviewers may be annoyed by that)

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  - ▶ Missing data is the worst!
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- ▶ Don't enforce good results, be honest
  - ▶ Avoid showing corner case scenarios, this will be spotted!
  - ▶ Don't hide alternative techniques that work better.
  - ▶ Sometimes, papers justifying that a technique is bad are good papers!
  - ▶ Often, plots are a support for proven results. They don't stand themselves as proofs.

Question every table with large number of zeros

Temp [°C]	Growth in 48 h [mm]
-50	0
-40	0
-30	0
-20	0
-10	0
0	0
10	0
20	7
30	8
40	1
50	0
60	0
70	0
80	0
90	0
100	0

Table: Effect of temperature on growth of oak seedlings

Not all numerical data must be put in a table

Temp [°C]	No. of expt	Aeration of growth medium	Growth
24	5	+	78
24	5	-	0

Table: Effect of aeration on growth of *Streptomyces coelicolor*

Nocillin	K Penicillin
5/35 (14)	9/34 (26)

Table: Bacteriological failure rates

When to use tables?

- ▶ If repetitive data must be presented
- ▶ If few determinations ⇒ data in text
- ▶ Put table (column) into words if reasonable
- ▶ Question every table with large number of zeros
- ▶ Give only significant data

Good Table

Parameters for downlink transmission scheme

Bandwidth [MHz]	f_S [MHz]	FFT size	# occupied SC
2.5	3.84	256	151
5.0	7.68	512	301
10.0	15.36	1024	601
15.0	23.04	1536	901
20.0	30.72	2048	1201

Table: Parameters for downlink transmission scheme

How to arrange tabular material

- ▶ Like elements should read down not across
- ▶ Words in a column are lined up left
- ▶ Number lined up right (or at decimal point)
- ▶ Vertical rules are normally not used
- ▶ Avoid double rules
- ▶ Avoid exponents in table headings
- ▶ Follow the journal's instructions

When to use a graph
If data shows pronounced trends

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If data shows pronounced trends

- ▶ Each graph should be as simple as possible
  ⇒ too much information confuses and discourages the viewer
- ▶ Group graphs together if they are most meaningful viewed together
- ▶ Graph and paper should function as a set
- ▶ Use same font and size as in text
- ▶ Don't extend the axes beyond of what the graph demands

Symbols and legend

▶ Use standard symbols ○ △ □ ● ▲ ■
▶ Use different symbols or different types of connecting line (e.g. dashed, dotted, etc.)
▶ Don't use only colors to distinguish curves
  ⇒ not visible when printed black&white
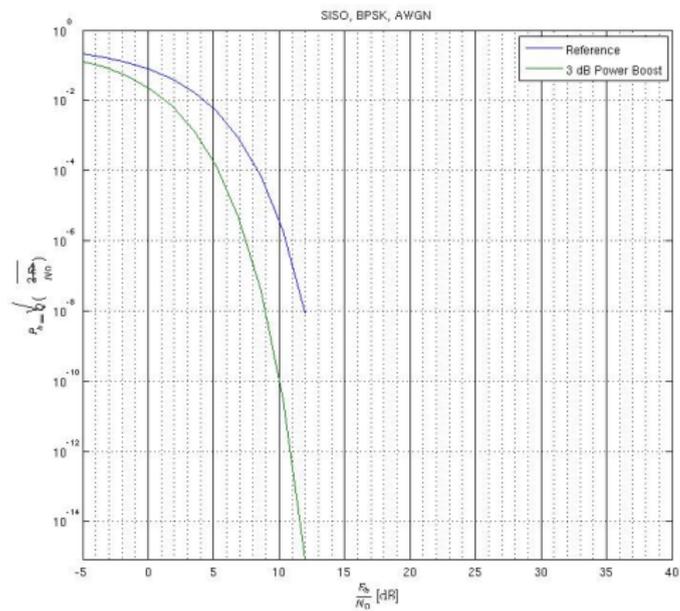▶ Use appropriate line width

Example: Bad Graph

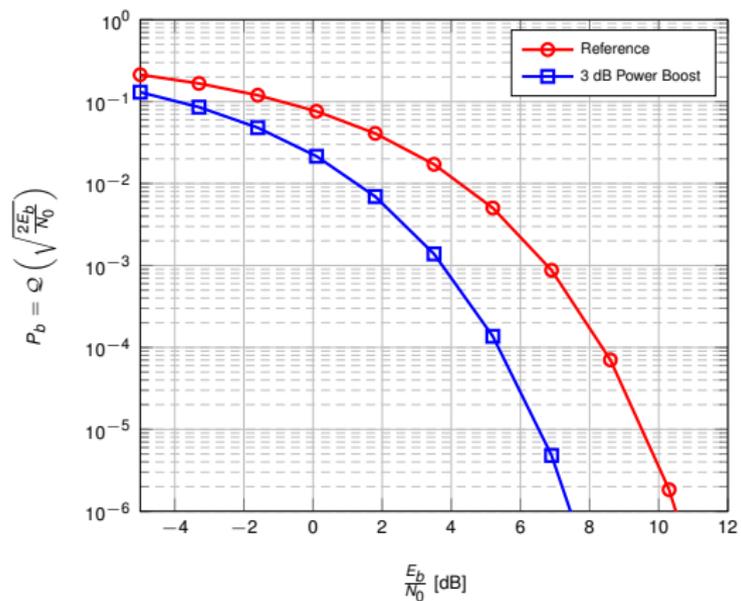Figure: BER vs. SNR, BPSK, AWGN

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  - ▶ only number what is referenced (unless for peer-review)
  - ▶ etc.

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    - Use only standard abbreviations
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Some further advices

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  - In most math articles, alphabetical order is preferred
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- **Paper size**:
  - Most papers are the pinnacle of months of work, so it is tempting to overwrite them
  - Keep the paper efficient: clear and simple so to convey the information fast and reliably
  - Respect page limitations: journals adapt themselves to most practical format
  - Readers won't read too long articles
  - When proofs are long and little informative for the contribution, keep them in appendices

Strategies for scientific writing

How to write a conference article

The objectives of a conference

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- ▶ **Conveying the information on your work**:
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      $\Rightarrow$ As a consequence, very bad presentations are found!
    - ▶ Conferences are ALL about presenting the work, not publishing a paper!
    - ▶ Prepare the talk **for** the audience, not to show off
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- ▶ **Opening your mind to other subjects**:
    - ▶ Often tutorials are there to discover new topics
    - ▶ Some conferences privilege very new contributions, even missing target
    - ▶ Often, the papers of interest to you were available online 6 months before.

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- As a PhD student, do not waste time on a conference paper: they barely count in your reference list.
  → Only use conferences for **communications**, not as a means for **publication**.

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  $\rightarrow$ Reviewers are often the same and you get a bad reputation
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When the journal is selected:

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  $\rightarrow$ Usually, only math papers are single-column.

Choosing the appropriate journal

The point of journal papers is to help science, not to grow your CV list.

Criteria to be remembered:

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- ▶ be prepared to adapt the scientific "jargon" to the community of interest.
- ▶ if not exactly your field, do not miss essential references from this community.

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- ▶ **Efficiency**: keep the content simple and clear (but well commented), not long for the sake of writing a "real" contribution
  - → Even a work of 2 years does not justify to be overly written.
  - ⇒ Do not try to reach the page limit, this is a stupid idea!
  - → More information is often too much information.

The IMRAD format

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- ▶ **Discussion and Conclusion**:
  - ▶ Make it efficient. Smart unequivocal comments.
    - → Fight against painful philosophical discussions!

Strategies for scientific writing

How to write the PhD thesis

The philosophy behind

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Best exercise from a researcher's approach:
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Best exercise from a researcher's approach:

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  - ▶ after 1 year of PhD, you should already think about it
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- ▶ 100-200 pages should not be seen as "a long document"
    ⇒ You need to have to say much more than that! Otherwise, something is wrong.

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  - conclusion / perspective: Recollects the overall contribution / gives an opening to your work
    - **don't spoil this section which proves you understand your field: this is the best testimony of your real expertise!**
    - opening should be smart/dedicated to your work only. Overall opening translates lack of autonomy.

Strategies for scientific writing

How to design slides

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  - No more than 15 slides
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- Good and bad presentations:
  - A bad presentation in front of people in your field can ruin your career!
  - A good presentation, even in front of 3 people, is always beneficial.

- Ultimate goal is to convey information about your work
  - make sure the slides are simple, clear
  - remove all unnecessary information for overall understanding

Objectives of a presentation

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    - ▶ make sure the slides are simple, clear
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- ▶ Convince the whole community of your strengths
  - ▶ the community is small (everybody knows everybody else): people off your field will talk about your presentation
  - ▶ keep in mind that you need to find a position after your PhD

Preparing the slides

General rules:

- ▶ Keep always in mind to be simple and clear:
  - ▶ Little content in each slide
  - ▶ Few slides (maximum 1/min)
  - ▶ No complete sentence, just few words, no verb
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- ▶ State-of-the-art must be well done
  - ▶ Make clear what has been done before, what's new here
    → Most people in the audience don't know the topic.
  - ▶ Correctly reference prior work
    → People in the room may work on the topic: they want to see their names!
    ⇒ Worst case: you show off on a subject already covered by someone in the room!

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    - ▶ Use clear environments (distinguish examples / theorems / independent items)
- ▶ Conclusion is often done but not so necessary (after 15min, everyone should remember what you said!)
- ▶ Opening / discussion of technical problems to be solved is important
    - ▶ a new proof approach is often what will be reused after you
    - ▶ people in your field must feel there is some grain to grind

Before the presentation: Checklist

- Rehearse your presentation beforehand
  - Know at least your slides' content
  - Don't rehearse too much to gain make it feel natural
    $\rightarrow$ Over-preparation and stress are visible and annoying
- Check that your slides are functioning properly
- Get to the hall ahead of the audience
- Make sure the projector is working
- Assure that your slides project
- Check the lights
- Check the microphone if you use one
- Check that pens/chalks are available if board is needed

When comes the presentation

$\rightarrow$ How to combat stage fright:

- ▶ Prepare so you feel confident
- ▶ Do not prepare too much so you feel obsessed
- ▶ Dissipate nervous energy e.g. take walk, exercises etc.
- ▶ Beware of too much caffeine, food or water

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$\rightarrow$ How to act during the presentation:

- ▶ Obvisouly, don't read notes!
- ▶ Too many ideas too quickly presented will be confusing
- ▶ Stick to most important points or results
- ▶ Don't proceed too fast especially at beginning
- ▶ Fit the allotted time slot (plan 9 min or 9.5 min if you have 10 min)
- ▶ Speak very clearly and avoid speaking quickly
- ▶ Look at the audience
- ▶ Show interest in your subject
- ▶ Avoid habits that might be distracting

- ▶ Irrelevant questions:
  - ▶ Deflect the discussion to something related you want to talk about.
    (e.g.:That's an interesting question, but a more immediate concern to us was...)
  - ▶ Offer to talk later

Q&A period

- ▶ Irrelevant questions:
  - ▶ Deflect the discussion to something related you want to talk about.
    (e.g.:That's an interesting question, but a more immediate concern to us was...)
  - ▶ Offer to talk later
- ▶ If you lack the answer
  - ▶ Admit that you don't know (do not panic)
  - ▶ Sometimes people ask to check that you know
    → Don't make up a wrong answer.
  - ▶ Offer to provide the answer later
  - ▶ Say how to find the answer

Strategies for scientific writing

How to make a poster

Preparing the Poster

- ▶ Guidelines:
    - ▶ Follow IMRAD format
    - ▶ Use very little text
      $\Rightarrow$ most space for illustrations
    - ▶ Clear statement of purpose (abstract) at beginning, in bulleted points, not in sentences
      $\Rightarrow$ people will read that part from afar, so make it clear!
    - ▶ Major part are the results
    - ▶ Brief discussion or conclusion (bulleted short sentences)

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- Detailed content:
  - Short attention-grabbing title
  - Choose appropriate typeface
  - Use bulleted and numbered lists
  - Should be self-explanatory
  - Lots of white space is important
  - Guide the viewer (what to look at first, second, ...)
  - Poster should contain highlights

Presenting the Poster

- ▶ Don't stay idle in front of the poster
  - ▶ Grab people passing by
  - ▶ Show willingness to present your work to others.

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- ▶ Consider handouts with more details
- ▶ Have some copies of your paper or related research

Strategies for scientific writing
The PhD defense

Around the defense

- The usual procedure:
    - **2-3 months before** the defense: thesis report sent to reviewers
    - **1 month before** the defense: reviewers send their reports with change suggestions
    - **15 days before** the defense: announcement of the defense is made
    - **D-Day** of the defense: 45min presentation + unlimited Q&A session
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- Specifics of the PhD defense:
  - 5 to 7 jury members, among which 2 reviewers (chosen by PhD advisor and validated by school)
  - the 2 reviewers receive the manuscript in advance and evaluate it, write a report
  - 45min presentation is not interrupted and must fit in time
  - during Q&A, only jury members ask questions
  - after all this, the jury deliberate and write the report
  - PhD applicant is made aware of the jury deliberation
  - since 2012, there is no grade anymore

$\Rightarrow$ Do attend PhD defenses to learn about the process AND to learn about new fields (if well done which is rare!)

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    - ▶ most PhD defenses are wasted because of stress and over-preparation
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   ► convey a message clear to everybody: jury + audience.

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▶ Make the problem statement clear and present properly what you will do:
  ▶ take your time on this, and explain the difficulties clearly and how you addressed them
  ▶ often, people skip this part to enter the real matter
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  ▶ the goal is not only to show you have good results but you can place them into a context
  ▶ you must justify your position as a world leading expert in your research area

$\longrightarrow$ **The Q&A session**

- ▶ Be prepared for questions
    - ▶ anticipate questions on the weakest points of your thesis
    - ▶ usually two types of questions
        - ▶ Very (overly) broad ones: they make sure you know other things than your PhD topic alone
        - ▶ Precise/technical ones: these should be easy to answer: they ensure you master the tools you use
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▶ Don't remain unresponsive
- ▶ either you propose a way to obtain the answer, give some hints/clues
- ▶ either, after giving it long thoughts, you admit you don't know

Softwares for scientific writing

Applied session of paper writing

The session

→ **Mutual review**,
- ▶ everyone brings an article or a draft of an article
- ▶ articles are shared and cross-reviewed:
  - ▶ the objective is to apply the learnt rules
  - ▶ the objective is to be very harsh

→ **LateX basics**,
- ▶ on computer, introduction to the basics of LateX
- ▶ basics to write conference articles / journal papers

Softwares for scientific writing

Applied session of figure drawings

The session

→ **Tables**,
- ▶ creating tables with LateX

→ **Figures**,
- ▶ getting used to PGFplots
- ▶ making Matlab and PGFplots interact

→ **Block diagrams**,
- ▶ getting hands on Tikz

→ **Drawings**,
- ▶ using Inkscape
- ▶ including LateX formulas in SVG files

Softwares for scientific writing

Slide/poster preparation

→ **Preparing slides**,
  ▶ using LateX to prepare slides
  ▶ abide by the rules described in first sessions

→ **Preparing a poster**,
  ▶ using LateX to prepare a poster
  ▶ abide by the rules described in first sessions

Softwares for scientific writing

Slide/poster presentation

$\rightarrow$ **Presentation of posters and slides**

- ▶ posters will be presented in a competitive/real-life situation
- ▶ slides will be presented in a PhD-defense type with jury and Q&A