

# Scientific Writing

Matúš Mihalák

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Good writing ... is clear thinking made visible

[Ambrose Bierce, 1937]

Writing is difficult! (Yet not too well practiced.)

# Importance of Good Writing

The readers will continue reading!

# Focus: Conference Papers

- Your Bachelor thesis is in the form of a conference paper:
  - 10 pages (including references)
  - 2 columns
  - (some additional material/details can be put to an appendix)

# Fundamental tenets

- It is often difficult to get started
  - just force yourself to write something, however clumsy
- Keep your prose simple and direct
  - much of written English is unnecessary complicated
  - avoid imprecise text
- To improve your writing skills
  - Get feedback
  - Read, and be critical (appreciate the good)

# Your paper: Your story

Don't write just for the sake of it!

- Think carefully what you want to say
- Tell it as **one single story**
- Don't make detours. Keep it linear.

# How to call yourself?

- Use “we”

# What tense to use?

## **Use active tense**

- “This has been analyzed” → “We analyzed this ...”

## **Use present tense within your writing**

- “This will be shown in Section 2” → “This is shown...”
- “Figure 3 depicts...”

## **Past tense**

- Conclusions & Discussion of results



# Writing a paper

# Title

- Titles are read. Papers not (1 in 500).
- Titles should help the reader to decide
  - whether to read the abstract/paper
  - should be informative
  - can be catchy
  - not the whole paper needs to be there

# Author List

- It is a good idea to put the authors in alphabetical order
- Some fields have different habits  
(ask your supervisor)

# Date

- Always date your work  
(helps to keep the overview over several drafts)  
(other people can place it in larger  
chronological context)

# Abstract

- Summary of paper
- Give enough information for the reader to decide whether to read the whole paper
- Write only AT THE END!
- Tips:
  - avoid math formulas and numbered citations,
  - try not to start with “In this paper...”,
  - talk about results as well (not only about the research question)

# Introduction

- It should introduce the problem,
- explain what the work (paper) attempts to do,
- and outlines the plan of attack.
- Also, a summary of results should be presented
- Include the “organization of the paper” at the end  
(A sentence per section.)
- Try to avoid bla-bla motivation (if it’s not sincere)

# Introduction (2)



## **Broad**

- big picture; significance; previous work

## **What is unknown**

- gaps in knowledge; open problems
- within some specific topic

## **Question**

- important, specific, and unresolved

# Conclusions

- Section with “Conclusions” is not mandatory.
- Don’t simply repeat earlier sections in the same words!
- Offer another viewpoing
- Discuss limitations
- Give suggestions for further research (if any)



# Acknowledgements

- For sure, acknowledge any financial support for the research such as: grants, fellowships, scholarship, studentship.
- Thank people who read the draft and gave substantial suggestions for improvements
- Either given as a footnote on the front page, or as the last section (not numbered) before References

# List of References

- Keep your references in BiBTeX format
- Use software such as JabRef for organizing your references
- Do not rely on the secondary sources (such as Google Scholar); always check the original reference
- Every reference in the list needs to be cited in the paper!

# (How to find references)

- Sometimes your work extends previous work: then the related work is easy to find (use, as a starting point, the previous work, and the references that the previous work used)
- Sometimes you have an original idea: then finding related work is difficult
  - Try to find research using several keywords from your research
  - Think of modeling your problem in the language of another mathematical theory → perhaps the problem has been studied in different field (using different language)
- If you find a very relevant paper: Google Scholar allows you to also find papers which cited that paper (very useful to find newer results on the topic)

# Appendix

Information that is

- essential to the paper
- does not fit comfortably to the body of the text  
(extra details of an analysis; algorithm listings;...)
- (or does not fit for page limits)

# How to

# Writing a proof

Readers are not interested in all details of a proof (argument): They hope to learn some new technique.

Help the reader:

- Emphasize the structure of the proof
- Mention the ease or difficulty of each step
- Highlight the key ideas that make it work

# Examples

- Use examples to explain general structures, statements, theories,...
- Even before you introduce formally the objects

# Definitions

- Use only when needed (sparsely)!
- Not everything needs to be defined in the introduction.
- Remind the reader of terms that have not been used for some time... “Recall that...”
- By convention, “if” means “if and only if” in definitions



# Words vs. Symbols

- Prefer words over symbols

“For every number  $\neq 1$  ...”  $\rightarrow$  “For every number that is not equal 1”

“We iterate over  $a[i]$ ,  $\forall i$  in  $\{1, 2, \dots, n\}$ ”  $\rightarrow$

“We iterate over  $a[i]$ , for all  $i$  in  $\{1, 2, \dots, n\}$ ”

# Punctuating expressions

- Mathematical expressions are part of the sentence, and so should be punctuated

“For every vector

$$v := A \cdot x,$$

where  $A$  is the transformation and  $x$  is the input, we output

$$\text{ret} := \|V\|.”$$

# Miscellaneous

- Don't start a sentence with a symbol
- Standard mathematical functions, e.g.,  $\sin$ ,  $\log$ ,  $\max$ ,  $\lim$ , are typed in roman font  
i.e.,  $\max$  and not *max*
- Multiple-letter variable names are also typed in roman

# Paragraphs

- Break text into paragraphs
- Keep one idea/topic per paragraph

# How to cite

- Preferred citing is using numbers such as [1]
- Example: This has been shown in [1].
  - use author names, where possible:

Peeters and Thuijsman show [1] that  $A=x$ .

- Hmm, we should stress the fact, not the publication:

Peeters and Thuijsman show that  $A=x$  [1].

# Further reading

- Look at the student portal, part “Thesis”
- Read parts of “Handbook of Writing for Mathematical Sciences” by Nicholas J. Higham
- “Writing Mathematical Papers in English” by Jerzy Trzeciak offers plenty of practical tips for writing.