



## Process of writing scientific text

- Idea or interesting topic
- Finding and evaluating relevant source material
- Reading material
- Identifying essential issues
- Restructuring them logically
- Writing them down using proper presentation
- Iterative process: text must be re-written several



## **Characteristics of scientific text**

- Content usually technical
- · Should be based on facts
  - Writer's interests and opinions can be seen in the choice of the topic, not in the text as such (student paper's normally contain justified opinions also)
- Based on former theories and research results
- Motivating on why the problem considered is important
  - · Not marketing of the ideas
- Arguments and conclusions
- Verifiability, reliability, and repeatability of the results



# Characteristics of scientific text

- Clear and logical structure
- · Not a direct copy from anybody else's text
- Source material is analysed and restructured
- Based on peer-reviewed research material
  - Journal, conference and workshop articles in computer science are typically peer-reviewed
  - Peer-reviewers are researchers that are experts in the topic in question
  - Writers do not know who the reviewers are



# **Characteristics of scientific text**

- Text is suitable for its target group
  - · How are the readers?
  - How are they going to use the text and the information given in it?
- Clearness of the text
  - The reader must understand the text in a same way as the writer
- Reflects writer's deep understanding of the topic!



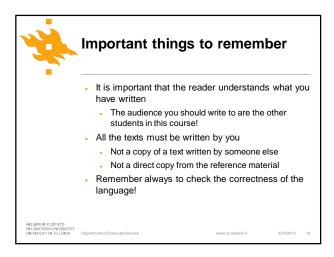
# Target groups of scientific text

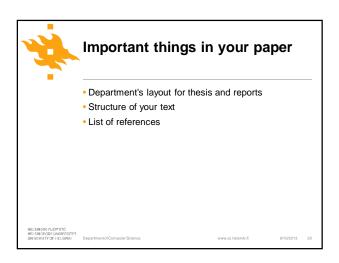
- Readers that have scientific background
- Other researchers in the same area
- Whole scientific community
- General public
- Some basic knowledge of the topic is usually required
- In this course and in the seminars: other MSc degree students

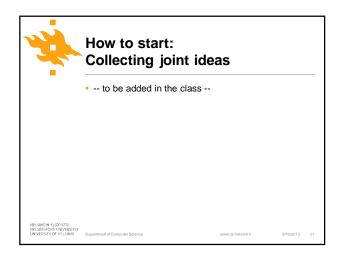


# How do you learn scientific writing?

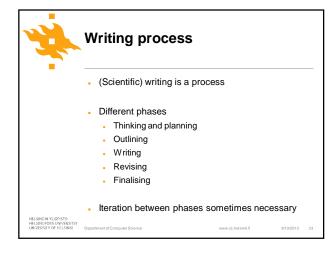
- Following the topic area and reading relevant
- Writing yourself
- Searching for feedback from others
  - Peer students
  - Teachers
- Iterative process!

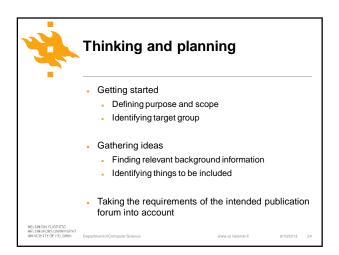














#### Getting started

- Define the purpose and scope of your text
  - What are the problems considered? Why are they
  - · What perspective is taken?
  - What are the objectives of the text?
  - Which purpose the text is written to?
- Who are the readers? (target group)
  - What the readers want to know?
  - · What information should be given to them?
  - In this course: your fellow students



## Gathering ideas

- Finding background information
  - · Information retrieval of scientific text
  - Reading the relevant material
  - · Defining the main references to be used
  - What kind of related work should be considered?
- Identifying things (topics) to be included and finding their relationships
  - · Key words, key phrases
  - Relevant concepts and definitions
  - The most important results to be presented



#### Outlining

- Starting point: What is text's scope and purpose?
- What does the reader need to learn or know about the topic?
- · Starting from the common knowledge and proceeding to the new ideas and results
- Logical structure and order of the text is essential!



# Outlining (2)

- Helps authors to
  - · organise their thoughts
  - evaluate relevance of different topics and their representation
  - remember the relationships between topics
- Should support reading and reader's understanding
  - Describes
    - · structure of the text
    - logical presentation and reading order
  - · Should still support several types of reading
    - browsing, specific information searches, learning,  $\dots$



# Outlining (3)

- Should lead to a logical, clear story
  - In a concise form in the list of contents
  - Clarified in the introduction, especially if there is something special in it
- · Questions to answer:
  - What topics are considered?
  - In which order they are told?
  - What is the importance and length of each topic?

# Outlining (4)

- What kind of parts are needed?
  - · Which chapters?
    - · Only in longer texts; seldom in scientific articles
  - Which sections?
  - · Which subsections?
  - · Some other parts?
- Finding
  - a good title for the whole text
  - headings for chapters, sections and subsections



# Outlining (5)

- Some publication forums may have strict rules on the outline
  - For example: Introduction, Methods, Results, Discussion
- Can cause problems in explaining complex topics in phases
  - For example a comparison of two methods => Introduction, Background, Methods, Results, Discussion, Methods, Results, Discussion

· Not typical in computer science



## Different types of outlines

- Chaining outline
  - · Presentation of the problem
  - · Related work, earlier solutions and their flaws
  - New solution
  - · Results and their evaluation
- Specificity-based outline
  - First general explanation/description, then more specific ones
  - For example for describing a system consisting of several components



# Different types of outlines (2)

- Example-based outline
  - · Idea or results explained first with help of a typical case or situation
  - Generalisation of ideas/results and describing them more formally
- · Complexity-based outline
  - · First presentation of a simple case
  - Then description of a more complicated case (generalisation, extension)



#### **Titles**

- A title of an article/thesis/report must be informative and concise
  - Too general terms and titles should be avoided
  - · Every term should be necessary
- Must be attractive
- Not too complicated and filled with words
- Not too short either

Preciseness is more important than conciseness and attractiveness!



# Titles (2)

- Examples:
  - - An Investigation of the Effectiveness of Extensions to Standard Ranking Techniques for Large Text Collections
  - Better:
    - Extensions to Ranking Techniques for Large Text Collections
  - Too general:
    - · Huffman Coding for Databases
  - Better:
    - · Limited-Memory Huffman Coding for Databases of Textual and Numeric Data



### Chapter and section headings

- Should reflect the structure of the work
  - For example
    - 4. List and trees
      - 4.1. Lists
      - 4.2. Trees
- Not complete sentences
  - Example:
    - Not: Replication of Data Leads to Reduction in Network Traffic
    - But: Replicating Data to Reduce Network Traffic



## Chapter and section headings (2)

- Not too lively
- · Avoid questions or abbreviations
- · Headings at the same level should
  - be comparable in their contents and structure
  - have a clear connection to the balanced outline
- Third-level headings, i.e. subsubsections, seldom needed
  - Usually the need of them indicates problems in the outline

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## Chapter and section headings (3)

- · Paragraph titles should be avoided
  - . If needed, should be part of the paragraph
- Numbering of headings depends on the publication forum
  - Unnumbered headings must be distinguished by a specific font, style or font size
  - At our department numbering of headings is required

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#### **Paragraphs**

- Building blocks of chapter, sections and subsections
- · Should not be too long
  - Logical flow of the text becomes difficult to follow
- Short paragraphs easier to read and they make communication more efficient
  - No paragraphs consisting of just one sentence!
- A paragraph for each aspect of the topic

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# Writing

- Scientific text should be impartial, accurate and objective
  - Arguments must be based on evidence
  - Statements should be supported by examples
  - Sources of information and ideas must be indicated
  - Use enough words to make your meaning clear
- Started by writing a draft of the text
  - Flow of ideas
  - · A short text can be drafted completely

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9/10/2013 40



#### First draft

- Freely written
  - Concentrate on presenting ideas in a logical way
- . Raw text
  - Style, layout and punctuation can be corrected later
  - Exception: mathematical and formal issues as precisely as possible from the very beginning
- Must be edited and revised carefully and thoroughly
  - Several times
  - Difficult things more times than easier

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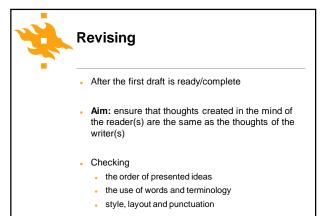
# How to proceed with writing

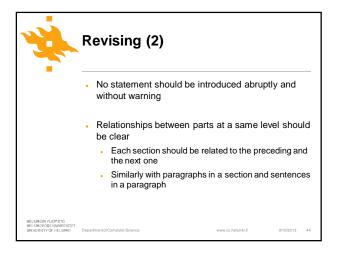
- Different approaches
  - Write the introduction first
  - Start from the body of the text
  - => use the method that is the best for you
- Write something even if it is hard
- Start with easier things
- If everything else is difficult, fix the technical details (list of references, etc.)

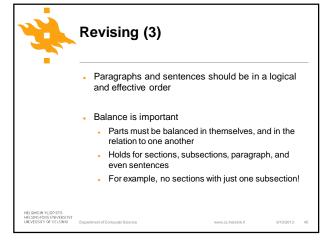
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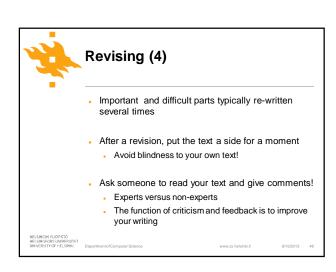
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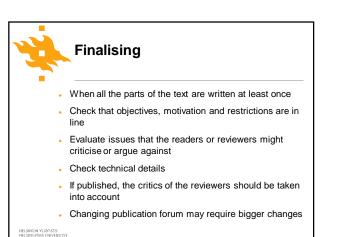
9/10/2013 42

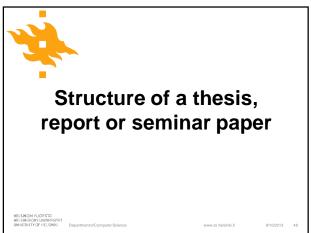


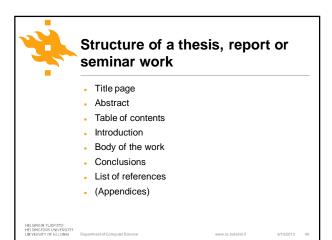


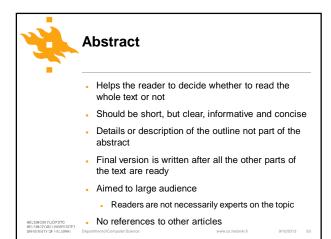


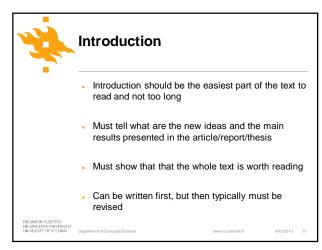


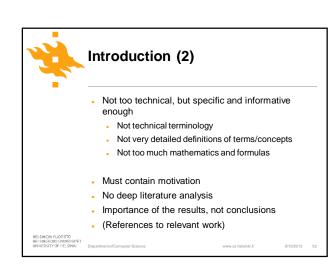


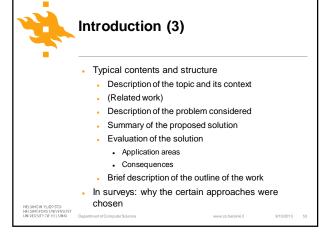


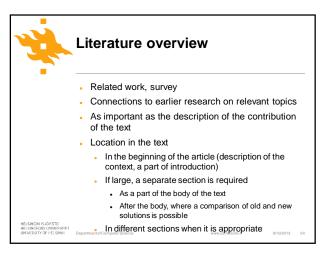














#### **Definitions**

- Terminology, variables, abbreviations and acronyms must be defined or explained the first  $\boldsymbol{time}$  they appear in the text
- Consistent emphasising
  - Different style of letters: italics, boldfacing, ...
  - · Only the first occurrence
- Sometimes several explanations can be good
- Definitions are given when needed
  - Usually a separate section "Definitions" is not needed/good
  - Every defined term should be necessary



## Results and their analysis

- Traditional order of presentation:
  - · Description of all results
  - Analysis of the results
- Drawback: the reader might not be able to follow what happens
- More reasonable order of presentation:
  - Analysis is combined with the description of results and how they are obtained
- Description of a particular result should usually start with a brief summary on the main observations



#### Conclusions

- Brief repetition of the main ideas, results and conclusions as well as their meaning
- Restrictions of the work can be repeated
- No new ideas or conclusions that are not presented in the body
- · Can be stated
  - Unsolved problems
  - Which points or perspectives were omitted
  - Which variations should be considered/researched



# **Divided authorships**

- All the authors have some kind of contribution to the contents of the article
- Brainstorming and developing ideas
- Even writing together
  - Each author write a certain part of the text (different styles, non-coherent style)
  - One or two authors write the draft, and other revise it in turns