



# Introduction to Scientific Writing

Cindy Perscheid

# Agenda

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- General
- Paper Sections
- Further Paper Recommendations
- Argumentation Style
- Accessible Writing Style

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Chart 2

# General – Aims of Research

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- Extend knowledge of mankind
  - Identify a **problem** that has not been solved yet
  - Formulate the problem or a question
  - Solve the problem/answer the question
  
- Have an overview of **existing approaches**, literature, and related issues
  
- **Organize your arguments** and results to be
  - Short,
  - Profound, and
  - Expressive

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Chart 3

# General – Types of Scientific Publications

- Methodical paper: New algorithms, systems, etc.
- Review / survey paper: Status quo / current status of a research area
- Concepts paper: New ideas or theories without concrete realization
- Evaluation paper: Quantitative comparison of different approaches
- Technical Report: Notification of current status of an approach within organization, usually no review

*most typical scientific  
publication*

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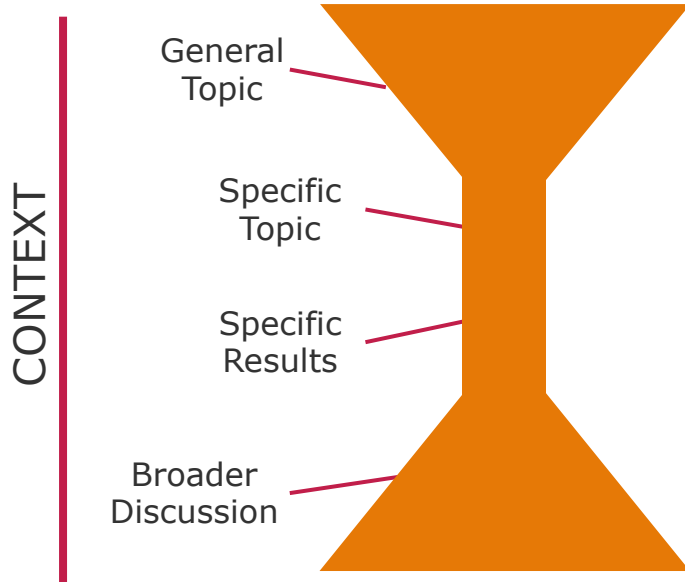
Chart 4

# General – Writing Procedure

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- Every paper **tells a story – know your story!**
  - What: What you want to find, the problem being solved
  - Why: Purpose and rationale
  - How: Your approach
- **Write for the reader, not for yourself!**
- Plan your document structure: Create an outline, discuss with others
- Write top-down: broad themes/ideas first, then go into detail

# Paper Structure – Hourglass



- Title
- Abstract
- Introduction
- (Background)
- Related Work
- Main Part
- Conclusion
- References

- Title
- Abstract
- Introduction
- (Background)
- Main Part
- Related Work
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- References

*See also: IMRAD structure*

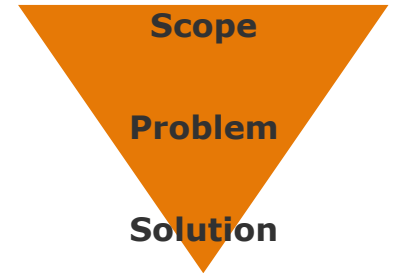
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Chart 6

# Paper Structure– Abstract

- Usually not more than 140 words
- Reflects the main story of the research paper
- **Calls attention** – make the reader curious about the content!
- Short and concise sentences
- Always follows a **funnel** structure
  - Scope – What is the general context?
  - Problem – What is the specific problem?
  - Significance – Why is it a problem?
  - Solution – How do you solve it?
  - Evaluation – Does your solution fulfill expectations (very short)?



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Chart 7



- Structure of abstract also applicable here, but in more detail
- First paragraph important: Reader decides here to continue reading!
- Particular tasks:
  - Introduce the topic and define the terminology
  - Indicate the focus of the paper and research objectives
  - Last paragraph outlines the structure of the paper
- Do not present your results here

*What is the problem you specifically consider?*





## ■ Purposes:

- Help understanding the field and the problem
- Show that you are aware of what is outside and appreciate the work of your colleagues
- Compare and differentiate your work with the state of the art

## ■ Content:

- Strategies of the different approaches, strengths/weaknesses
- How do we address potential shortcomings? (Contribution!)

## ■ Useful instrument: Comparison table with your important criteria

	Approach A	Approach B	Our Approach
Criteria 1	x	x	x
Criteria 2	x	-	x
Criteria 3	x	x	x
Criteria 4	-	-	x

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Chart 9

# Related Work – Hints for Literature Review



- Backward/forward search for publications in online archives
  - IEEE: <http://www.computer.org>
  - ACM: <http://www.acm.org>
  - Google Scholar: <http://scholar.google.com>
  - Citeseer: <http://citeseer.ist.psu.edu/>
  - Uni Potsdam Library: <http://info.ub.uni-potsdam.de/>

The screenshot shows a Google Scholar search interface. The search bar contains the term "biclustering" and a magnifying glass icon. Below the search bar, it indicates "Articles" and "About 8,690 results (0.08 sec)". On the left, there are filters for "Any time", "Since 2018", "Since 2017", "Since 2014", and "Custom range...". The main result is a PDF titled "[PDF] Biclustering of expression data." by Y Cheng and GM Church, published in 2000 on researchgate.net. The abstract describes an efficient node-deletion algorithm for finding submatrices in expression data. The result includes a star icon, a document icon, and statistics: "Cited by 2272", "Related articles", "All 15 versions", and a double arrow icon.

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Chart 10

# Paper Structure– Main Part



- Conceptual part – Particular algorithm
- Implementation part – Architectural aspects of your prototype
- Results – What experiments did we run and what did we observe?
- Evaluation – What are the reasons for our observations?
- Discussion – What do these findings mean for our approach?

*Can also go in one  
chapter*

*Remember your  
Chemistry protocols at  
school?*

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- **NOT a summary:** Sum up your findings, not what you have done
- Answer research questions/objectives
- State the importance of discovery and future implications
- Strong statements should be made (avoid “it may be concluded...”)

# Further Recommendations – Figures

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- Good figures can make a paper come alive
- Good figures communicate ideas or patterns in the data much better than big tables of numbers
- Choose reasonable captions
- Be aware of printing resolutions (300 dpi for colors, 600 dpi for b/w)
- Prefer shadings over colors – documents are usually printed in b/w mode

*Be aware of  
color blindness*

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Chart **13**

# Further Recommendations – Tables

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- Captions should not be too long, but also not "*architecture of ...*"
- Same with figures: Choose reasonable captions
- Explain content in more detail in the text
- If something is not worth explaining it in text → do not put it in the table

# Further Recommendations – Footnotes

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- NOT for parenthetical comments – important things must be in the text
  - Footnotes should be used for things the typical reader can genuinely skip
  - Websites etc. also do not belong into footnotes, list them as reference
- Footnotes stop readers, so better try to avoid

# Further Recommendations – Citing

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- Direct speech
  - *"With method ... we achieve ..."*
  - *X claims he "... has developed a methodology ..."*
- Indirect speech – rather name system instead of authors
  - *X has developed a method ...*
- Reference is not a subject of sentence – list it at the end of sentence
  - X has developed a method ... [1].



# Proper Argumentation – What is an Argument?

An **argument** is a series of statements in which one or more statements (premises) are intended to support a statement (conclusion).

This is just the standard form! You could also begin with the conclusion

**(1)** 1st premise

**(2)** 2nd premise

...

**(n)** n-th premise

---

**(c)** Conclusion

**(1)** All cats are mammals.

**(2)** All tigers are cats

---

**(c)** Tigers are mammals.

# Deductive Arguments – Make your Arguments Logically Valid

In an argument, the conclusion follows from the premises, if the conclusion has to be true in case the premises are true (were true).

**Deductive Argument:** An argument is called *valid*, if its conclusion follows *logically* from the premises.

You do not need any background information to check that!

In other words: If the reader agrees on the premises, he **MUST** also agree on the conclusion.

- (1) All cats are mammals.
- (2) Tigers are cats.

---

- (c) Tigers are mammals.

**VS.**

- (1) Unicorns like ice cream. ⚡
- (2) I like ice cream.

---

- (c) I am a unicorn.

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Chart 18

# Deductive Arguments – Soundness

An argument is called "**sound**", if  
a) it is valid, and  
b) its premises are true.

(1) All cats are mammals.  
(2) Tigers are cats.  

---

(c) Tigers are mammals.

***Sound***

**vs.**

(1) Unicorns like ice cream. ⚡  
(2) I like ice cream.  

---

(c) I am a unicorn.

***Logically Invalid***

**vs.**

(1) All dogs are chairs. ⚡  
(2) Richard is a dog.  

---

(c) Richard is a chair.

***False Premise***

## **Always check your deductive arguments for two aspects:**

- (1)** Does the conclusion follow from the premises? (=LOGIC)
- (2)** Are the premises true? (=TRUTH)

*Example 1:* Paris is the capital of France. That is why Europe should not admit more refugees.

*Example 2:* All refugees are terrorists, and Europe should not admit terrorists. That is why Europe should not admit more refugees.

*Example 3:* The NPD is an anti-semitic party. Anti-semitic parties should be banned. Therefore, the NPD should be banned.

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Chart **20**

**Inductive Argument:** An argument that is intended to be *strong* or *forceful* rather than valid.

The acceptance of this argument depends on the reliability/credibility of the source!

**(1)** According to source S it is the case that X.  

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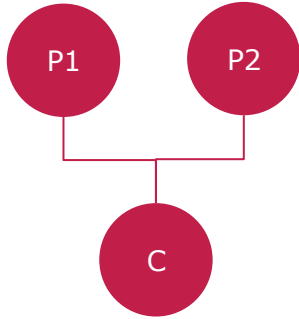
**(c)** X.

S = {  
Observation  
Study  
Expert  
Experience  
...

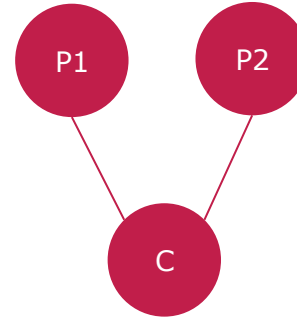
*Example 1:* Literature shows that ... [3-10]

# Argumentation Structure Types

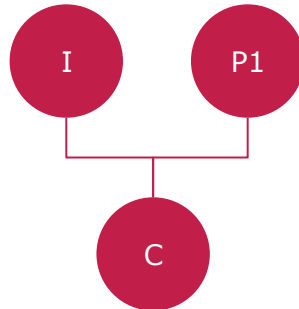
(a) *Standard Argument*



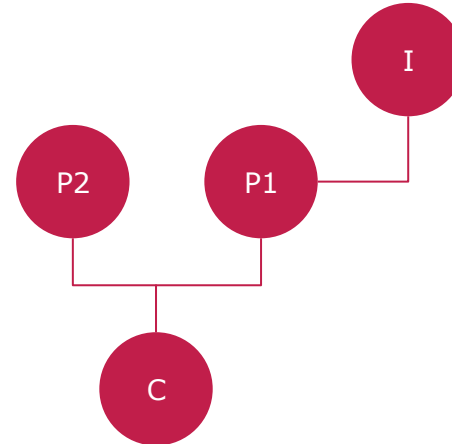
(b) *Parallel Argument*



(c) *Mixed Argument*



(d) *Nested Argument*

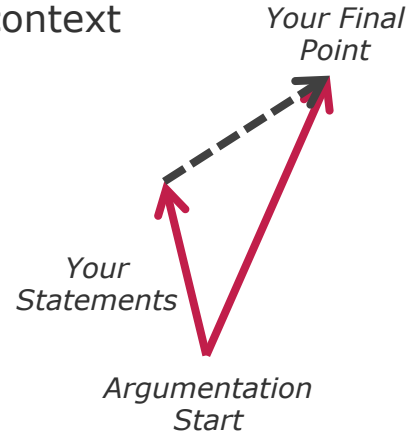


# Recommendations for Written Argumentation

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- Make deductive arguments valid
- Do not mix arguments
- State your conclusion explicitly
- Define important concepts
- Do not use synonyms

- Make reading the easiest for the reader
  - Write in an accessible style (no complicated sentence constructs)
  - No one can read your mind – provide enough context



- Reading pages of dense text is **no fun**
  - Make room for white spaces
  - Make content structure visible at first sight
  - Do not overload with 40 graphs – provide the key facts and points



# Accessible Writing Style – Main Rules for Accessible Writing

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- Use verbs that are concrete
- Have simple things as grammatical subjects in your sentences
- Avoid clutter
- Active = Life, Passive = Death!
- Make your paragraph coherent

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Chart **25**

# Accessible Writing Style – Informative Verbs

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- Put activity and information into your verb

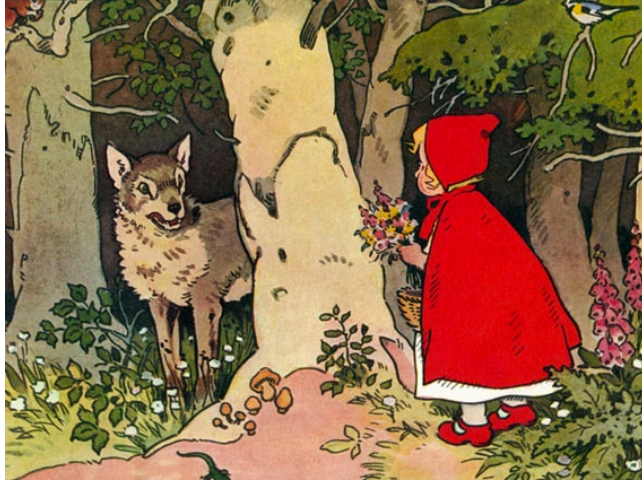
*The data offer confirmation of the view that substance xy causes the destruction of neurons.*

*→ The data **confirm** the view that substance xy **destroys** neurons.*

*The obtained trend was positive and significant; depicting that over the years there has been certain increase in the night time surface ozone concentration over the study region.*

*→ The obtained trend was positive and significant. It **shows** that over the years the night time surface ozone concentration **increased** over the study region.*

# Accessible Writing Style – Little Red Riding Hood Principle



Once upon a time, as a walk in the woods was taking place on the part of Little-red-riding-hood, a jump from behind a tree by the wolf occured, causing a fright reaction.

Long and complicated subjects

Once upon a time, as Little-red-riding-hood was walking in the woods, the wolf jumped out from behind a tree and frightened her.

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Chart **27**

# Accessible Writing Style – Avoid Clutter

- Unnecessary meta-language

~~Another important aspect of the topic of sleep which should definitely be stressed at this point is that~~ sleep deprivation impairs concentration.

→ *Sleep deprivation impairs concentration.*

- Unnecessary adjectives or adverbs

*At the moment, there is a ~~huge~~ gap in the ~~existing~~ literature on autonomous driving regarding the politics ~~and policy dynamics~~ behind autonomous driving.*

- Little qualifiers ("kind of", "a bit", "somehow" etc.)

# Accessible Writing Style – Coherent Paragraphs

- Repeat main concept in a number of sentences

(1) Whales feed on plankton.

(2) Plankton is a source of nutrients for whales.

↑  
Topic  
Position

↑  
Stress-  
Position


Start your sentence with  
known concepts and end  
with new insights

# Accessible Writing Style – Further Recommendations

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- Keep sentences short and precise (German problem...)
- Use **present** tense – do not switch tenses
- First sentence of a paragraph = lead sentence!
- Do not use abbreviations in headlines
- Avoid (self) assessments - *groundbreaking, good,...*
- Avoid vague statements - *possibly/probably, could/would/should,...*

# Accessible Writing Style – Further Recommendations

- Be aware of the difference between ***such as*** and ***like***
  - *like* applies for closed bodies, i.e. you list all existing examples
  - *such as* applies for open d., i.e. there still exist other examples
- “*Ice cream like vanilla*” vs. “*Ice cream, such as vanilla*”
- Check **correct reference** of your verbs if you have multiple objects
- “*This results in incomplete patient records which eventually ...*”  

- Check your formulations for **correct meaningfulness** and reference
- “*a method called HMW question*” vs. “*a method called formulation of HMW question*”
- Use **uniform phrasing** in listings
- “*I like eating and to run*” vs. “*I like eating and running*”

# Accessible Writing Style – Further Recommendations

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- Do not describe circumstances - *"after eight hours we realized ..."*
- This and that: Avoid references to previous sentences by using them
- That and which: If you can put a comma before it, use which
- Choose the way of your parenthesis according to importance
  - Important: Comma
  - Good to know: Hyphen
  - Actually not important at all: Braces (avoid these! ;)



# Accessible Writing Style – Further Recommendations

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- Absolute statements: Always relate to units
- Consistency throughout the text - spelling, formatting, etc.
- Think about what to highlight: no exclamation marks, use italic
- Do not continuously refer to earlier or later pages
- Add paragraphs between section headline and first subsection

# And Finally...

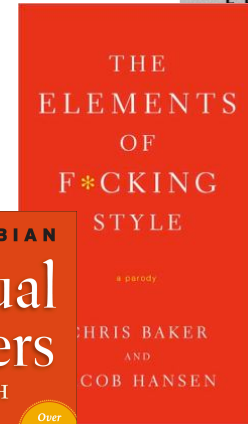
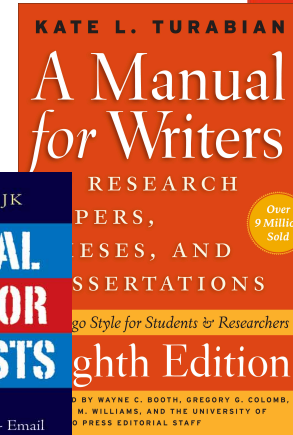
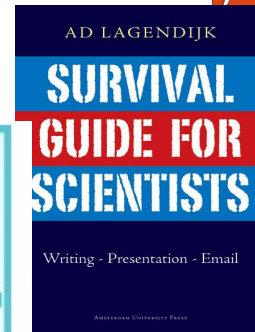
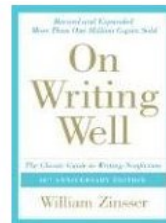
## Before Submitting Any Paper

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- Are headlines uniformly formatted, e.g. capitalized?
- Are proper tenses and voices used?
- Are all equations mathematically correct and explained in the text?
- Are all abbreviations explained/introduced?
- Are all figures/tables relevant and of good quality?
- Are all figures, tables, and equations listed and mentioned in the text?
- Are all references relevant, up to date and accessible?
- Are the references structured in a uniform format?

# Useful Links and Books

- Ad Lagendijk: Survival Guide for Scientists: Writing - Presentation - Email
- Academic Phrasebank: <http://www.phrasebank.manchester.ac.uk/>
- The Purdue Online Writing Lab - <http://owl.english.purdue.edu/>
- <http://www.cs.columbia.edu/~hgs/etc/writing-style.html>
- <ftp://fast.cs.utah.edu/pub/writing-papers.ps>
- [http://www.itc.nl/library/Papers/hengl\\_rules.pdf](http://www.itc.nl/library/Papers/hengl_rules.pdf)
- [http://www-net.cs.umass.edu/kurose/talks/top\\_10\\_tips\\_for\\_writing\\_a\\_paper.ppt](http://www-net.cs.umass.edu/kurose/talks/top_10_tips_for_writing_a_paper.ppt)



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Chart 35