

How to write good (mathematical) papers?

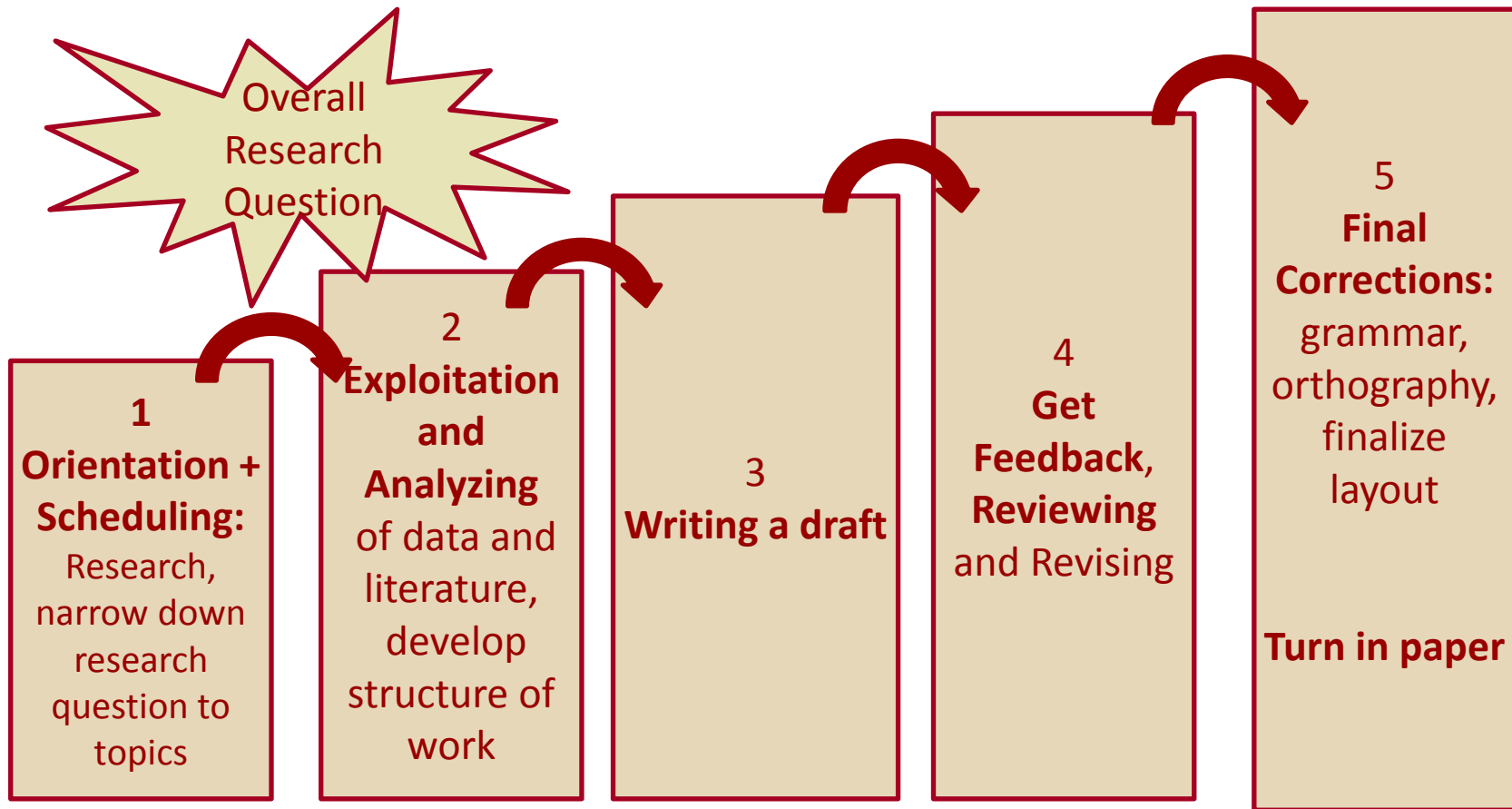
Some ideas and tips

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Mannheim University Library
29.06.2017

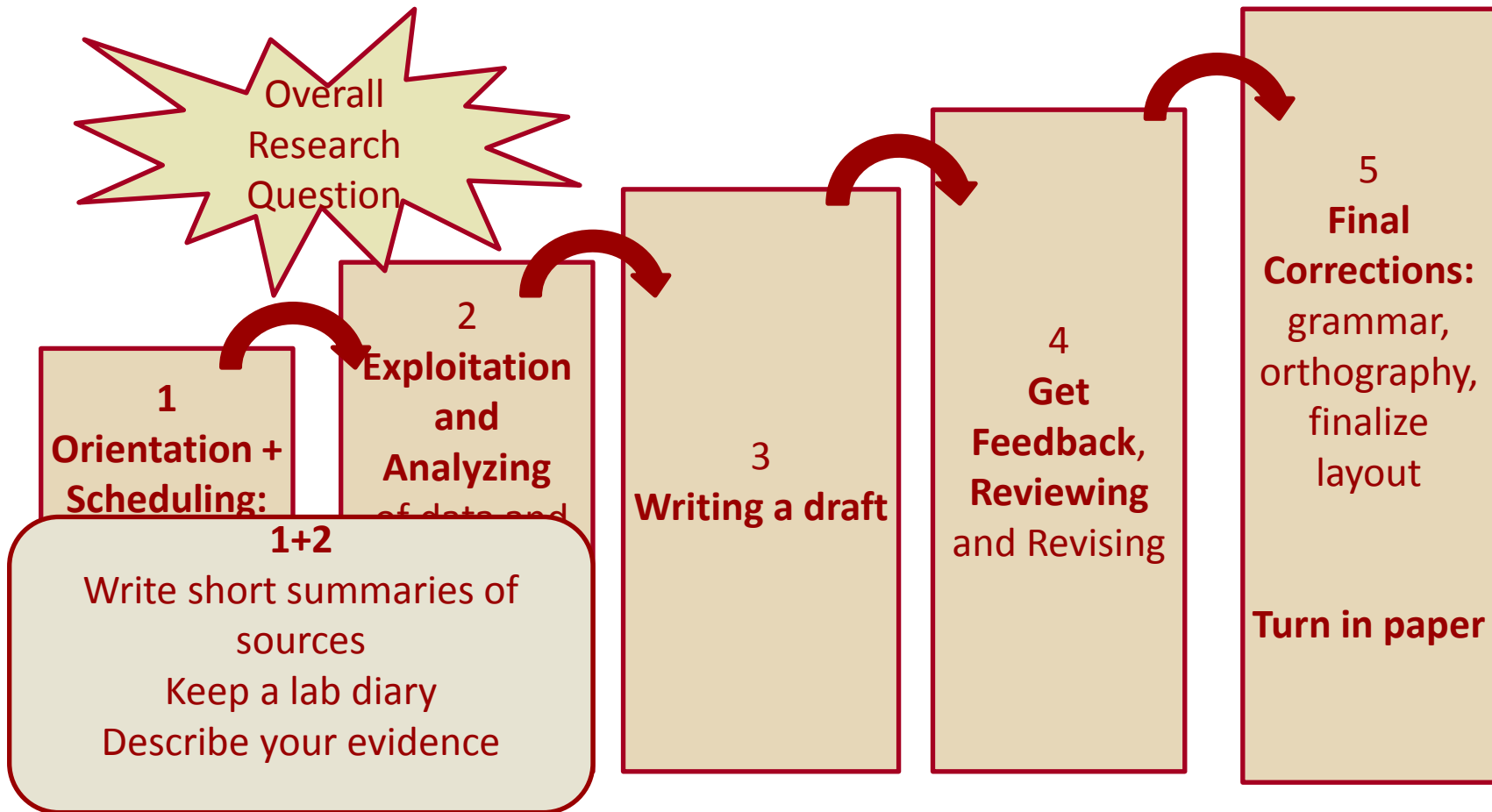
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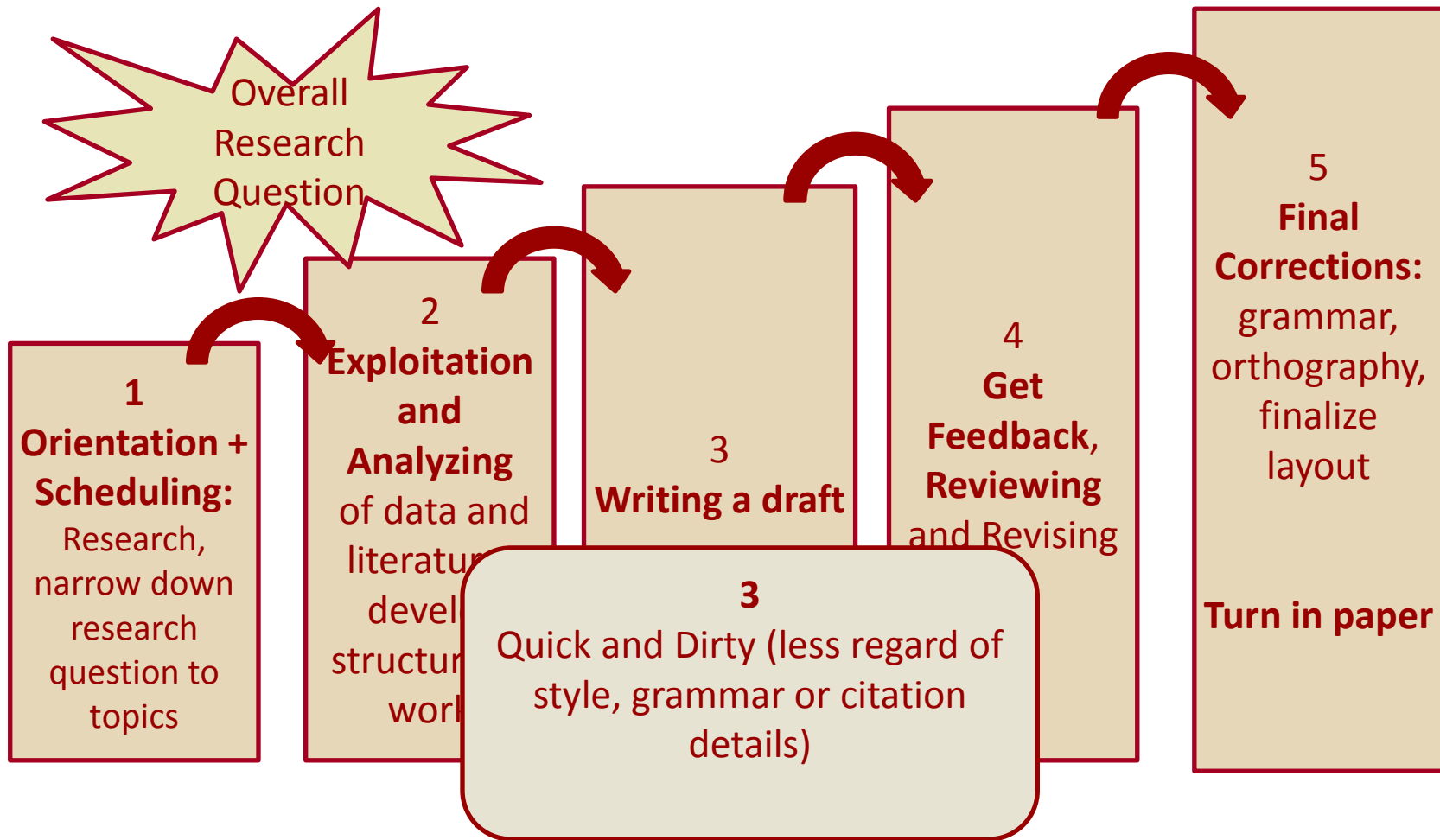
Bring the Writing Process to Mind



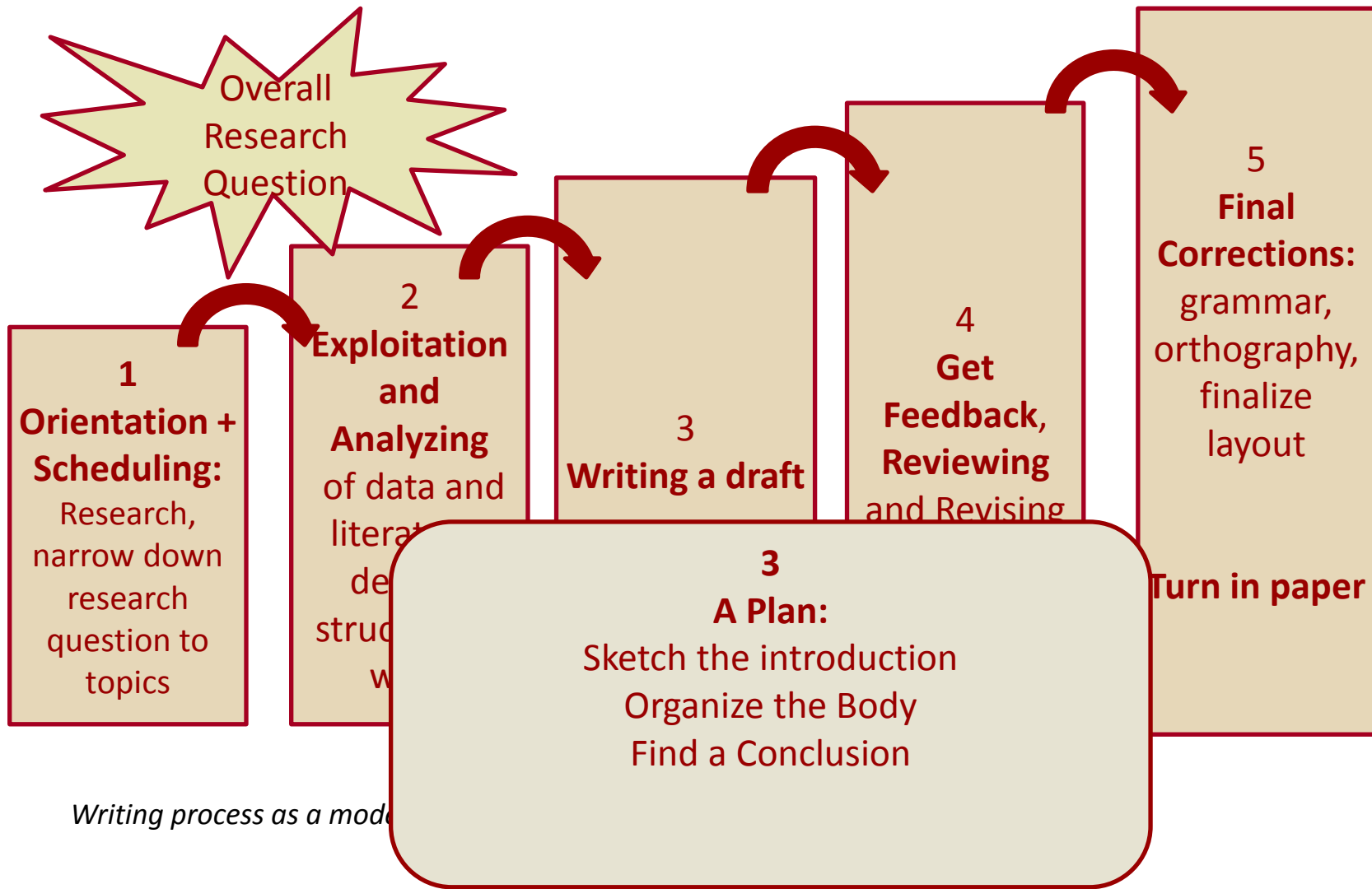
Writing process as a model, according to Girgensohn/Sennewald 2005



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Writing process as a model, according to Girgensohn/Sennewald 2005



Writing process as a model

Regard the Writing Process

- Visualize phases of writing process when scheduling the entire project -> helps you to keep up with your **time management**
- Set each phase as a „**Milestone**“ -> A number of smaller todo-packets is easier to cope with than one big one.
- **Limit the working time** you spent with each phase
- **Be aware:** Reviewing is a very important phase which requires (almost always) more time and effort than supposed

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The phases of the writing process are typically not linear at all, but often **recursive**.

Types of Writers: *The Planner (Strategist)*

- Develops structure at first, text is generated out of headwords
- Delays writing out the text in full

good	Not so good
Keeps track of the entire work from the start	Writing lasts longer, being pressed for time is hardly tolerated
Does not get lost in the subject, no digressions	Less open-minded for new ideas in an early stage of writing already
Text needs less revisions	Struggles with very complex subjects

Types of Writers: *The Spontaneous*

- Produces text offhanded and kind of associatively
- Structure occurs throughout writing

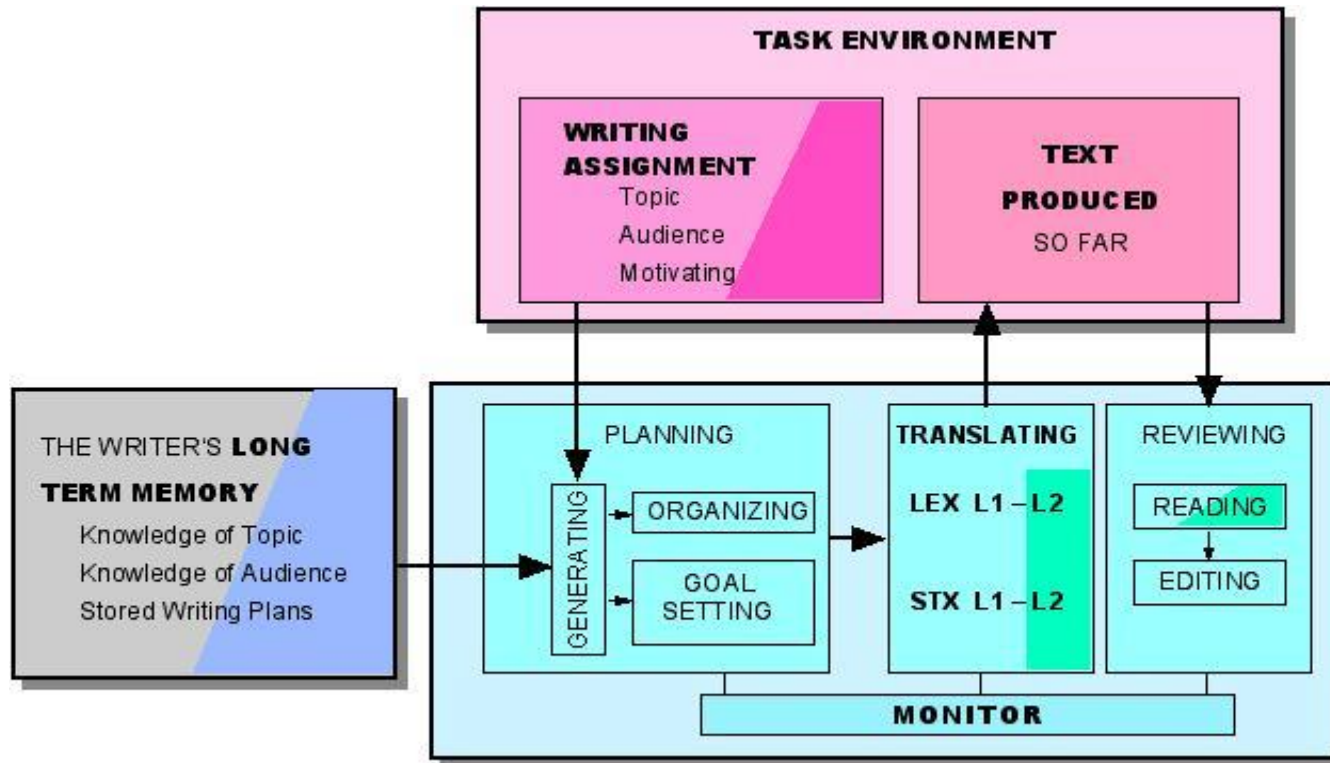
Good	Not so good
No „fear of the blank sheet“	the writers perspective is in focus not the audience
Many (fresh) ideas, authentic	Text needs extensive revision
Quick results, although in pressure of time	

Types of Writers: *The Editor*

- Perfectionist
- Structure and „Core“ of a text are a result of correcting over and over

Good	Not so good
Produces Text easily	Endless revises and re-revises
Focus on the reader from an early state of work	Entraps in bits and bobs
Appropriate, elaborate Style	A lot of frustration and less „working flow“

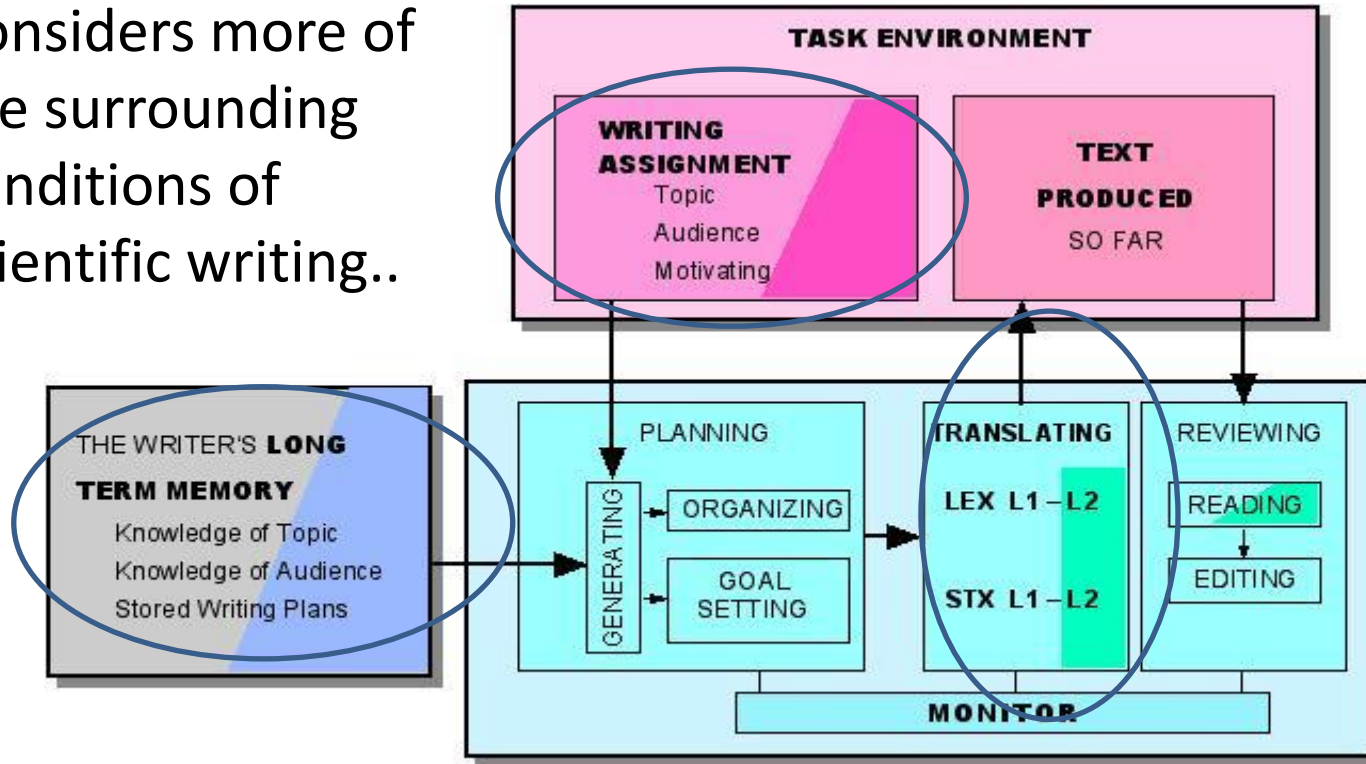
Another Model of Writing Process



L2-Writing based on Hayes & Flower 1980 Structure of the writing model Griebhaber 2005

Another Model of Writing Process

Considers more of the surrounding conditions of scientific writing..



L2-Writing based on Hayes & Flower 1980 Structure of the writing model Griebhaber 2005

Scientific English as a non-native Speaker

Some Tips

Word order *subject-verb-object* is only rarely altered, keep subject and verb close to each other

Write out all verb forms – avoid *it's*, *doesn't*

Avoid starting sentences with *And*, *But*, *Because*

Avoid ending sentences with *too*, *also*, *though* or *yet*

Signaling action: start a sentence with a gerund („-ing“) and a subject
Starting a sentence with a gerund is a different story

Use more verbs, less nouns

Common error: Compared with vs compares to. *Similar order of things are compared with one another, different orders of things are compared to one another*

.....

Against Procrastination - Your Personal Task Environment

- *Morning person or night owl?* Schedule Creative Writing on your favorite time of the day
- Use the not so creative hours for literature research, formal corrections etc.
- Set a number of „Milestones“, make „down-to earth“ plans about your every day writing pensum. How planned are your days? Due of important private appointments? Schedule leisure time and rest!
- Arrange your writing zone (at home? In the library? In the café?) free from distractions

Against Procrastination - Your Personal Task Environment

- Get unplugged! 😊 Grant a rest to your mobile phone and avoid social networks



Source: <https://www.flickr.com/photos/birgerking/6875893248>
by Hunter Lang

- Choose flow instead of distraction
- Grant a rest to your mobile phone and get unplugged

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Some Ideas about Good Writing

Some Ideas about Good Writing

Even brilliant thoughts are only impressive if they can be easily get by your readers instead of being hidden in a text-jungle.

The probability of writing a sentence perfectly the first time is vanishingly small

Revising and polishing a draft is essential and frequently the difference between good and less good writing!

Some Ideas about Good Writing

Difficulties of Rewriting

You will hardly notice ambiguities and explanatory gaps
You know what you meant to say and you understand the omitted steps

Lay the manuscript aside for a while

Try to read it as your grandmother or your rubber duck or (...)
ask yourself: *Have I been told yet what this concept means? - Has the logic of this step been demonstrated?*

The ability to anticipate the audience level of understanding at each point is a very good skill:

Good writing is good teaching

Some Ideas about Good Writing

Get Feedback! If your colleagues find something unclear, don't argue with them - as unclarity detectors, readers are never wrong

The word processing program is very virtuous to make cosmetic changes but mostly not an adequate restructuring tool!

Some Tips for Writing Coherent Texts

To guide the audience through the text use *signposts*:

- *Headings and subheadings* tell what the readers are going to meet in this section
- *Summary sentences* (e.g. the final sentence of a section)
- *Words for Transition*: *however, similarly, furthermore,*
- Use *announcements* and *back references* (.....)

Check each section/ paragraph

How does it relate to the overall research question?

Which question of detail should be answered in it?

Start every chapter with referring to the overall question or the preceding chapter

End every chapter with a summary or a transition to the next chapter

Matters of Style

Omit needless words

Good writing is concise. A sentence should contain no unnecessary words / a paragraph no unnecessary sentence. Try to spend 15 Minutes each day omitting needless words!

Write short simple sentences

Make paragraphs

one idea per one paragraph

first sentence of every paragraph is the „topic“ sentence“ and shows the reader what the paragraph is going to be about

Matters of Style

Use Repetition and Parallel Construction

Don't substitute synonyms for recurring words and vary the sentence structure, this can be confusing

Repetition and Parallel Constructions bring clarity

Jargon

the specialized vocabulary of your discipline functions as a short-cut,

it is more precise or free of surplus meanings than any natural language equivalent. If it is not, choose natural language

Matters of Style

Voice and self-reference

in the past: majority of academic writing was in the passive voice, the authors referred to themselves in the third person

This experiment was designed by the authors to test..

today: use the active voice (more direct, shorter, clearer), do not refer to yourself as *we*, keep self-reference to a minimum

Avoid metacomments on the writing

do not divert the readers attention away from the topic

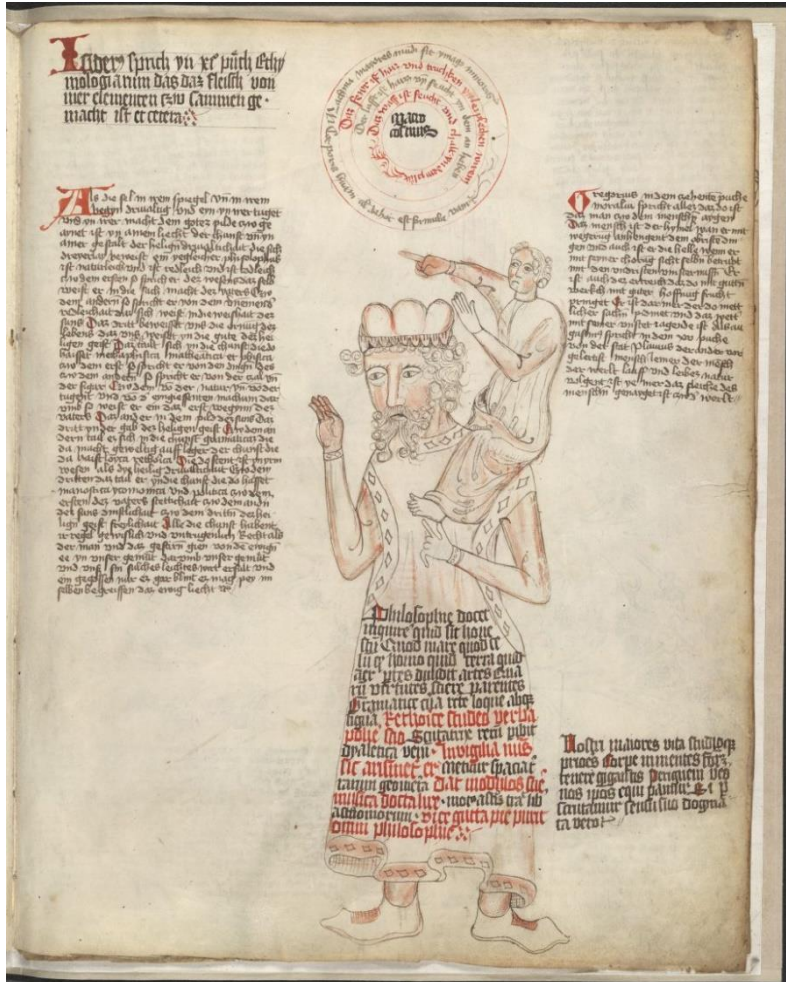
Avoid language bias

No generic use of *man, he, his, him* to refer to both sexes

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Citations and how to avoid plagiarism

Standing on the shoulders of giants



“If I have seen further, it is by standing on the shoulders of giants.” Newton 1676

Always state on who’s shoulders you’re standing!

Encyclopedic manuscript containing allegorical and medical drawings
South Germany, ca. 1410 [Rosenwald 4](#) (image 15)

http://lcweb2.loc.gov/cgi-bin/ampage?collId=rbc3&fileName=rbc0001_2006rosen0004page.db&recNum=14

Plagiarism

Plagiarism = using someone else's work without attribution

Plagiarism is the one thing you absolutely must avoid!



Graphic by „user8“ on

http://de.guttenplag.wikia.com/wiki/Datei:Thumb_xxl.png retrieved on 2017-04-03

Copy and paste w/o attribution

- Doe (2008), p. 18:
- 80% of respondents were tempted to procrastinate by using Facebook, hence we predict a similar pattern for Twitter usage.
- You:
- 80% of respondents were tempted to procrastinate by using Facebook, hence we predict a similar pattern for Twitter usage.

Plagiarism

Attribute everything!

- Doe (2008), p. 18:
- 80% of respondents were tempted to procrastinate by using Facebook, hence we predict a similar pattern for Twitter usage.
- You:
- Based on the findings by Doe, that “80% of respondents were tempted to procrastinate by using Facebook” (Doe 2008, p.18), we strongly expect the same correlation in using Twitter.

Plagiarism

Different forms of plagiarism

- Translation without attribution is still plagiarism
- Self-plagiarism
- Copy and paste text w/o attribution
- Copy and paste pictures w/o attribution
- Copy and paste tables w/o attribution

Common Knowledge

- No attribution is needed for common knowledge
- But what is common knowledge in your area?
 - Pythagorean Theorem
 - $E = mc^2$
 - The fact that the number e is irrational.
 - Knuth's soundex algorithm
 - Schwartz-Zippel Theorem
 - ...?

Second-hand quote

- Doe (2008), p. 18:
- 80% of respondents were tempted to procrastinate by using Facebook, hence we predict a similar pattern for Twitter usage.

- Smith (2010), p. 3:
- The findings by Doe (2008, p.18) shows that “80% of respondents were tempted to procrastinate by using Facebook”.

- You:
- “80% of respondents were tempted to procrastinate by using Facebook” (~~Smith 2010, p. 3~~) **(Doe 2008, p. 18)**

- **But if** Doe 2008 is inaccessible, then it is **possible** to quote:
- “80% of respondents were tempted to procrastinate by using Facebook” **(Doe 2008, p. 18, as quoted by Smith 2010, p. 3)**



Mathematical Writing

Writing only mathematical symbols

$$x \in \mathbb{R} \quad x > 0 \quad x > 3 \rightarrow x^2 > 9$$

$$\forall x \exists y \quad x \geq 0 \Rightarrow y^2 = x$$

$$\begin{aligned} x &\in \mathbb{R} \\ x^2 - 16x + 63 &= 0 \\ x &= 7 \quad x = 9 \end{aligned}$$

- Hard to read, also the math is easy.
- How are the different lines/equations connected?

Writing Mathematics in Sentences

- Write in full sentences
- Include mathematical formulas in these sentences
- Include punctuation in mathematical formulas
- Try to not start a sentence with a symbol
- Examples:
 - Let x be a real number.
 - Assume $x > 0$.
 - If $x > 3$, then $x^2 > 9$.

Example: Sentences with math. formulas and full punctuations

For each $x \in X$ we have the decomposition $x = \xi + \lambda$, with $\xi \in \Xi$ and $\lambda \in \Lambda$; accordingly, we define the function $P: X \rightarrow \Xi$, $x \mapsto \xi$, which extracts the first component of x .

$$x \in X$$

$$x = \xi + \lambda$$

$$\xi \in \Xi$$

$$\lambda \in \Lambda$$

$$P: X \rightarrow \Xi, x \mapsto \xi$$

$$x$$

Writing Definitions

“A definition requires a pause, to give the reader time to absorb it. This may be achieved by **giving the definition twice**, first with words then with symbols (or vice-versa), by using two different formulations, or by **supporting the definition with an example.**” (Vivaldi 2014, p. 104ff)

Example: Writing Definitions

For each $x \in X$ we have the decomposition $x = \xi + \lambda$, with $\xi \in \Xi$ and $\lambda \in \Lambda$; accordingly, we define the function $P: X \rightarrow \Xi, x \mapsto \xi$, which extracts the first component of x .

Example: Writing Definitions

The arrow notation is defined for all natural numbers $a, b \geq 1, n \geq 0$ by

$$a \uparrow^n b = \begin{cases} a, & \text{if } b = 1; \\ a \cdot b, & \text{if } n = 0; \\ a \uparrow^{n-1} (a \uparrow^n (b - 1)), & \text{else.} \end{cases}$$

Examples:

$$3 \uparrow 1 = 3$$

$$3 \uparrow 2 = 3 \cdot (3 \uparrow 1) = 3 \cdot 3$$

$$3 \uparrow\uparrow 2 = 3 \uparrow (3 \uparrow\uparrow 1) = 3 \uparrow 3$$

$$3 \uparrow\uparrow\uparrow 2 = 3 \uparrow\uparrow (3 \uparrow\uparrow\uparrow 1) = 3 \uparrow\uparrow 3$$

$$3 \uparrow\uparrow 3 = 3 \uparrow (3 \uparrow\uparrow 2) = 3 \uparrow 3 \uparrow 3$$

The Art of Formulating Theorems

Schwartz-Zippel Theorem: Let F be a finite field of size q , let $n \geq 1$, and let $P \in F[x_1, x_2, \dots, x_n]$ be a polynomial of degree at most $d < q$. If P is non-zero then the number of zeros of P in F^n is at most dq^{n-1} . (Or let S be a finite subset of an arbitrary field F , then P has at most $d|S|^{n-1}$ zeros in $S^n \subset F^n$.)

[Formulation from a Ph.D. student](#)

The Art of Formulating Theorems

Schwartz-Zippel Theorem: Let \mathcal{F} be a field, let d be a natural number, and let S be a subset of \mathcal{F} . Then for every non-zero polynomial $f \in \mathcal{F}[x_1, \dots, x_n]$ of degree d , the number of n -tuples $(r_1, \dots, r_n) \in S^n$ with $f(r_1, \dots, r_n) = 0$ is at most $d|S|^{n-1}$. In other words, if $r_1, \dots, r_n \in S$ are chosen independently and uniformly at random, then the probability of $f(r_1, \dots, r_n) = 0$ is at most $\frac{d}{|S|}$.

[Formulation by Prof. Matoušek](#)

The Art of Formulating Theorems

- Explain first notation (linear reading order, reader does not have to go forth and back to understand)
- Theorem is understandable independently, i.e. everything which is important is part of the theorem
- Choose variable names which are meaningful, e.g. d for degree, S for subset
- Accurate (e.g. choose indep.+uniform at random)
- Only a few sentences

Further Resources: Books

Vivaldi, Franco (2014): Mathematical Writing.

- in Central Lending Library: 2014 A 4510 (see [3D plan](#))
- <https://doi.org/10.1007/978-1-4471-6527-9>

Trzeciak, Jerzy (2005): Writing Mathematical Papers in English - a practical guide, rev. edition.

- in A5 library branch: SB 820 T876 (see [3D plan](#))
- http://www.ems-ph.org/books/show_pdf.php?proj_nr=34&vol=01

Higham, Nicholas J. (1998): Handbook of writing for the mathematical sciences.

- <https://doi.org/10.1137/1.9780898719550>

Krantz, Steven G. (2016): A Primer of Mathematical Writing, 2nd Edition

- <https://arxiv.org/abs/1612.04888>

Further Resources: Books

Wallwork, Adrian (2016): English for writing research papers. 2nd edition.

- in Central Lending Library: 2017 A 0861 (see [3D plan](#))
- 1st edition: <https://doi.org/10.1007/978-1-4419-7922-3>

Glasman-Deal, Hilary (2013): Science research writing : for non-native speakers of English

- in Central Lending Library: 2015 A 1726 (see [3D plan](#))

Booth, Colomb, Williams (2016): The Craft of Research. 4th edition.

- 4th edition is ordered for the library
- 3rd edition (2008): 2008 A 3203, 2008 AU 0494

Further Resources: Others

Lübbecke, Marco (2014): How to write a Paper [Blog Post]

<https://mluebbecke.wordpress.com/2014/11/21/how-to-write-a-paper/>

Griffies, Stephen M., Perrie, William A., Hull, Gaëlle (2013): Elements of Style for Writing Scientific Journal Articles [Elsevier Brochure]

https://www.publishingcampus.elsevier.com/websites/elsevier_publishingcampus/files/Skills%20training/Elements_of_Style.pdf

Questions? Comments?

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- Weapons of Mass Distractions
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