Seminar - Data Visualization

HowTo: Paper Writing

SS 2020

Michael Kern, Christian Reinbold,
Prof. Dr. R. Westermann
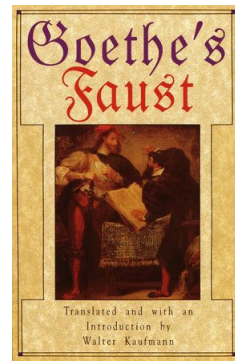
Computer Graphics and Visualization Group
Technische Universität München

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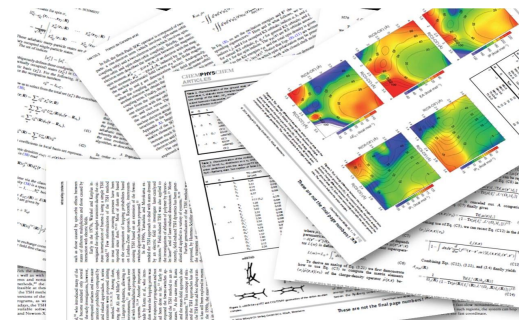# Scientific Writing vs. Literary Writing

Literary Writing

- In (science) fiction, facts don't have to be correct / exact
- Narrative, imprecise, creative, pictorial, …
- Poetic and lyrical style of writing

Scientific Writing

- Exact, precise, consistent, appropriate
- Simple, objective, neutral type of writing
- Facts, Facts, Facts!

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Scientific Writing

- **Focus on the basics** / essentials ("Wesentliche")

- **No slang** "Get rid of" → eliminate / remove

- **No personal ratings** / conclusions in the text **without proof**:
    - Words like: *it makes sense, important, good / better / best, often, several, normal, faster, slower*

- **No new synonym** for fixed scientific terms:
    - Such as alternating use of *graphics memory, video memory, VRAM*

    → **choose one term**

- **Proof your statements** with trustful references / sources

- Avoid adjectives → **Be objective!**

Scientific Writing

- Don't be too abstract:

  Support facts with clear, specific examples

- Infinitely unaware, but infinitely intelligent readers:
  - **Explain everything**, but only once. **No redundancy**

- Use **short sentences** instead of long, complex, nested sentences
  - Scientists have to read a lot papers → support their understanding

- Abbreviations: **write out in full for the first time**:
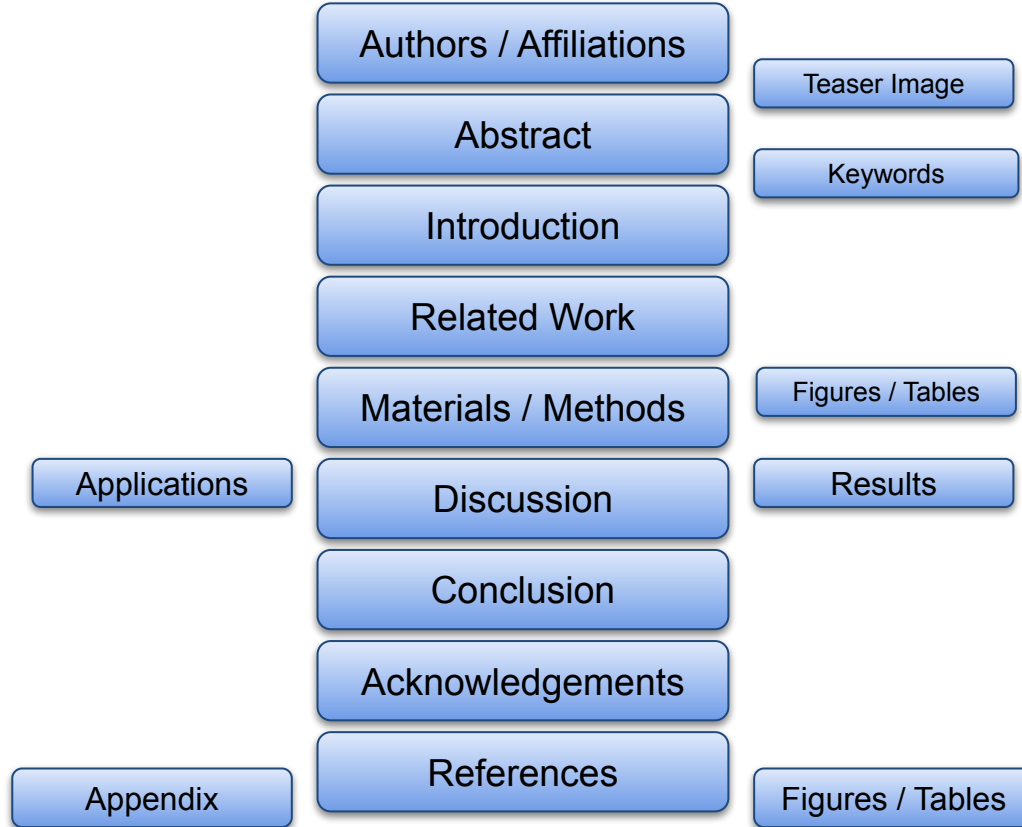 *Video Random Access Memory (VRAM)*

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Scientific Writing: Active and Passive

Do not use first-person perspective (I show, I will explain, …)
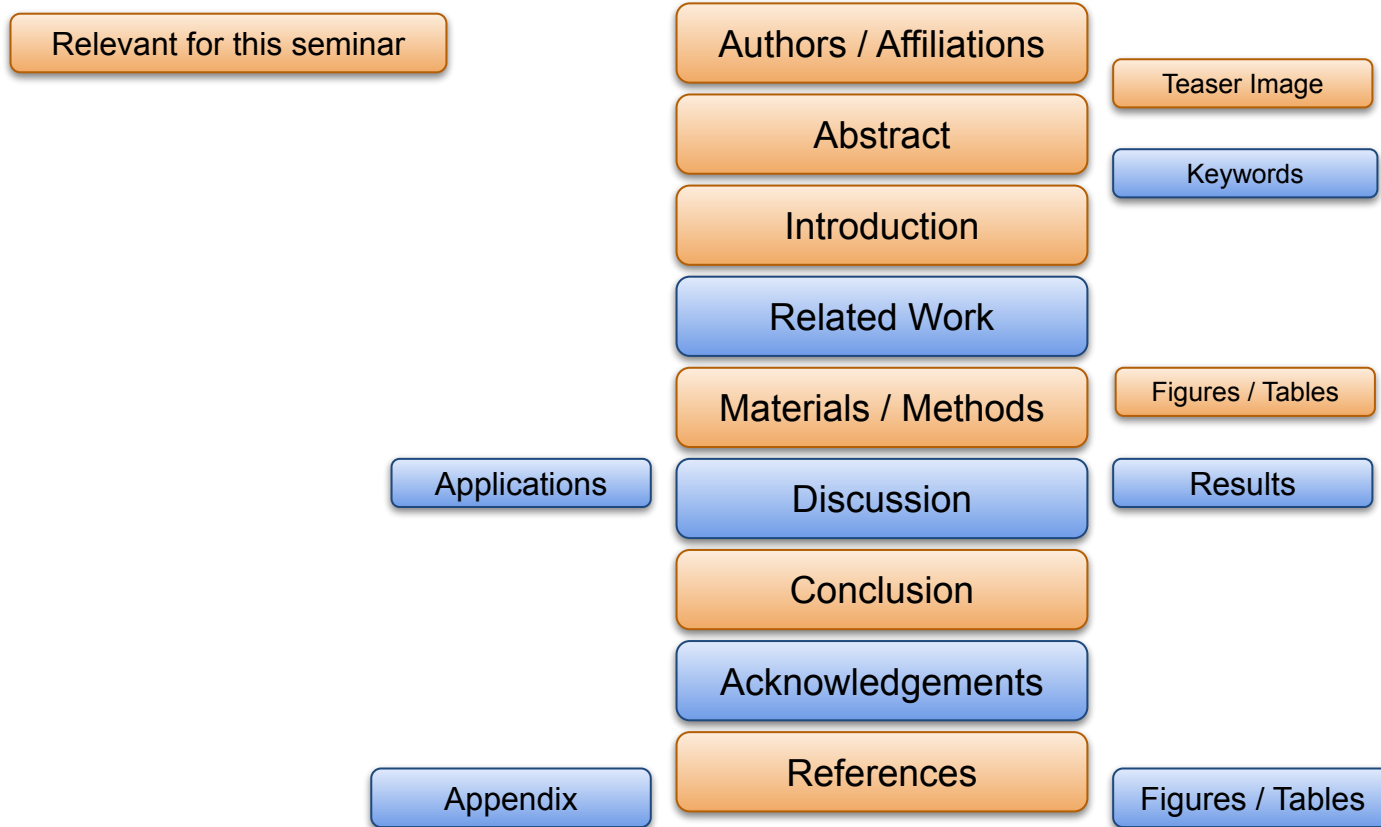**→ Does not guarantee objectivity**

Instead:

● Use **we** (the authorship of this paper, the group of scientists) → We show, we demonstrate, …

● Use the **passive**: This method will be described in the following

● Use the **active**: This paper deals with …, this figure shows ...

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Typical structure / outline

Authors / Affiliations

Teaser Image

Abstract

Keywords

Introduction

Related Work

Materials / Methods

Figures / Tables

Applications

Discussion

Results

Conclusion

Acknowledgements

Appendix

References

Figures / Tables

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Typical structure / outline

Relevant for this seminar

Authors / Affiliations

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Appendix

References

Figures / Tables

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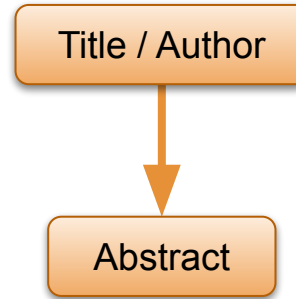
Structure / Outline

Readers don't read linearly:

- Start with title / abstract
- Have a look at the figures and captions
- References are important!

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Structure / Outline
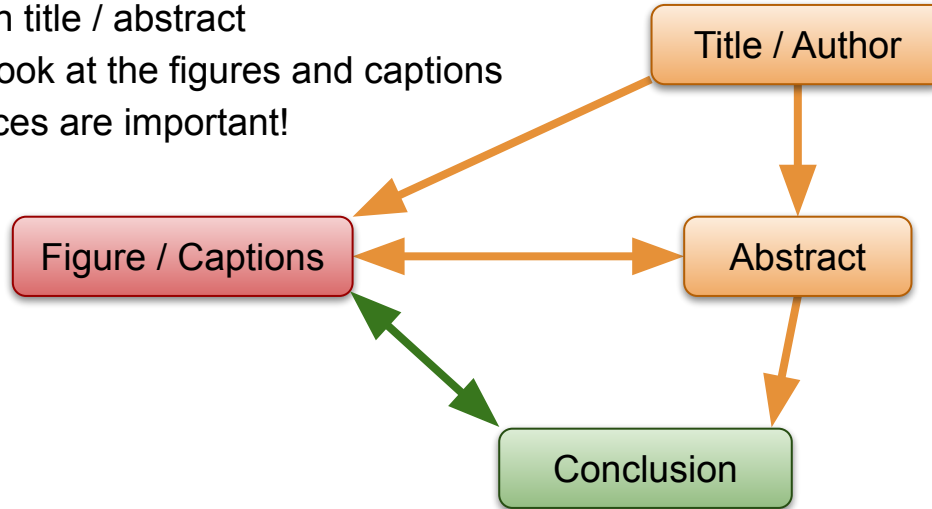
Readers don't read linearly:

- ● Start with title / abstract
- ● Have a look at the figures and captions
- ● References are important!

Structure / Outline

Readers don't read linearly:

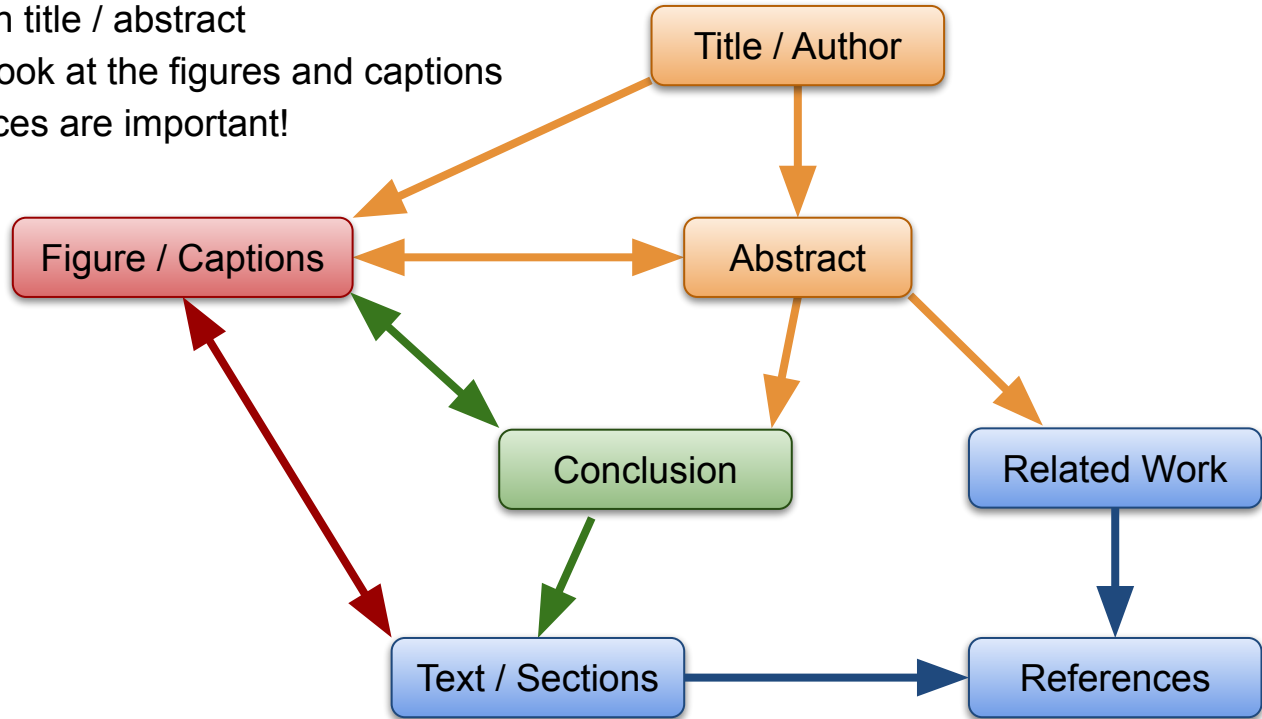- ● Start with title / abstract
- ● Have a look at the figures and captions
- ● References are important!

Structure / Outline

Readers don't read linearly:

- Start with title / abstract
- Have a look at the figures and captions
- References are important!

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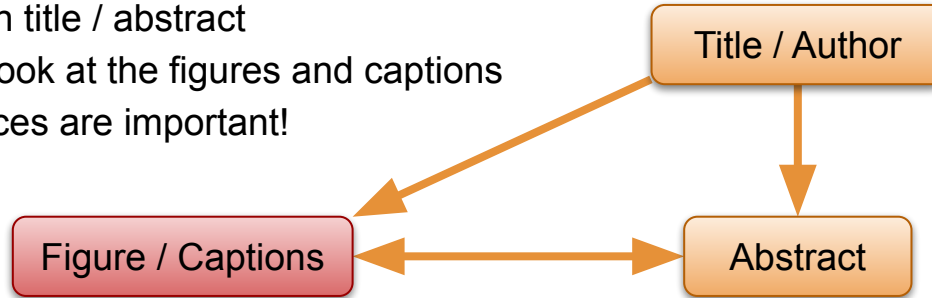
Structure / Outline

- **Abstract** ("Zusammenfassung")
  Summarize the key elements / contributions / essentials of your paper in a few sentences

- **Introduction** *(Introduce your topic)*
  - Explain the problem and key questions
  - Introduce common terms
  - How can your method contribute to the solution of the problem?

- **Common Thread:** *("roter Faden")*
  Meaningful structure from introduction to conclusion

- **Conclusion** *(Summarize your paper)*
  - Exhibit contribution of your paper
  - Summarize / review results and methods (advantages / drawbacks)
  - Draw conclusions and present an outlook

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Abstract

- Basic Introduction / Background
- Statement of the general problem
- Main results and explanation
- Results in general context
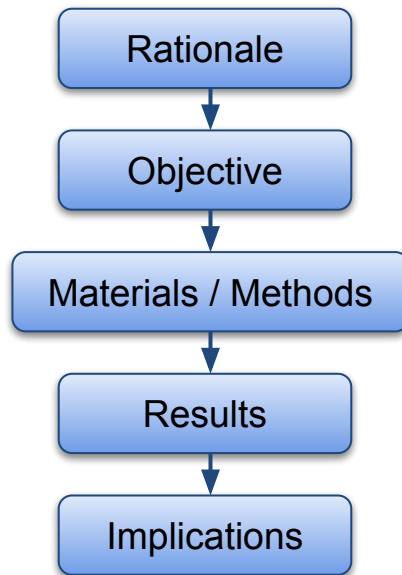- (Broader) perspective / outlook

Rationale: What is the problem? Why?

Objective: What is the goal?

Methods: How was this goal achieved?

Results: What are the findings?

Implications: So what? Why should one bother? Brief outlook?

Introduction

Theory: Draw the big picture, what is the theory behind the problem? What is the State-of-the-Art?

Relevance: Why is this problem relevant in this research field?

Gap: What has not been done, so far? What is missing? What could not be solved?

Research Question: What problem / issue are you explicitly addressing?

Solutions: Briefly explain the methods / solutions to this problem? Contributions?

(Outline: What is the structure of the paper?)

Theory

↓

Relevance

↓

Gap

↓

Research Question

↓

My Solutions

↓

Outline
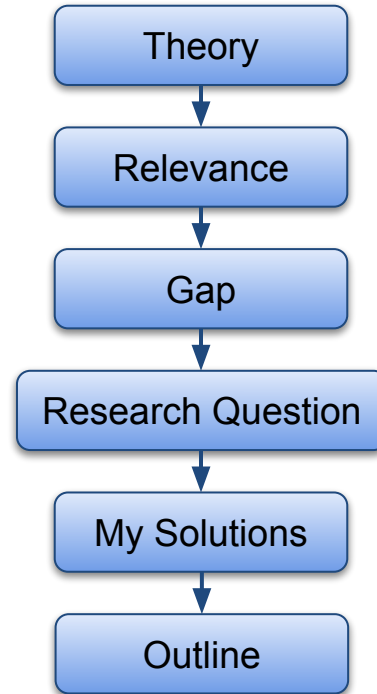
Conclusion

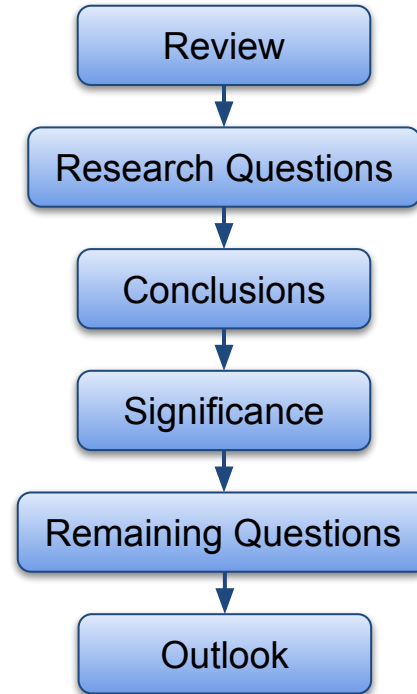**Review**: Summary of the results.

Research Questions: Couple your results to the research questions mentioned in the introduction.

Conclusions: Draw conclusions to **fill the gap**.

Significance: What new insights have been gained by your results? Are they significant?

**Remaining Questions**: What has not been solved / could not be solved?

*(**Outlook**: Future work and research.)*

Review

↓

Research Questions

↓

Conclusions

↓

Significance

↓

Remaining Questions

↓

Outlook

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Figures

- **Meaningful illustrations** and sketches

- **Figures support the text**, but must not explain everything

- **Size and caption** font size hast to be **appropriate**

- Caption:
  - Contains **enough information** to understand the figure
  - But should be **as short as possible**
  - First sentence describes the key elements of the figure
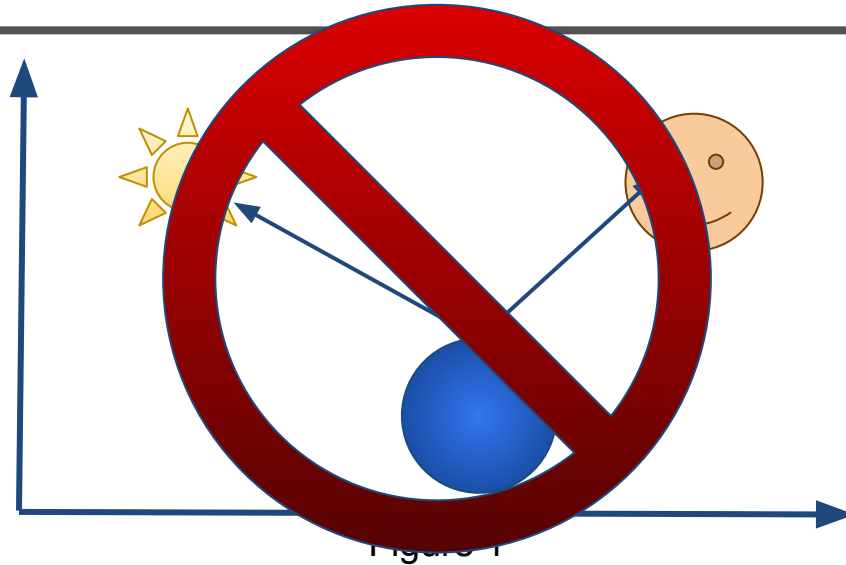 - **Avoid redundancy** in text and figure captions

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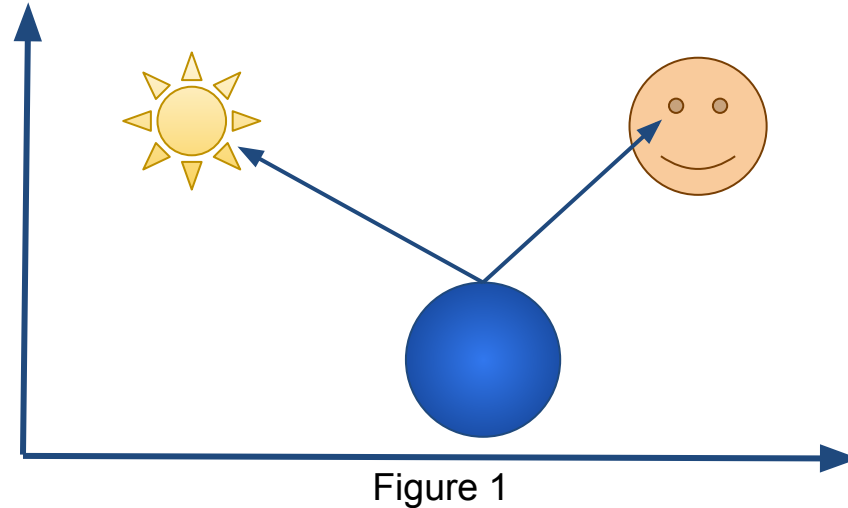
Figures

Figure 1

This figure is hard to interpret!

- What do the objects / arrows represent? → **Unclear**

- What does the image want to illustrate? → **Unclear**

- **Caption is useless**, only says "Figure 1"!

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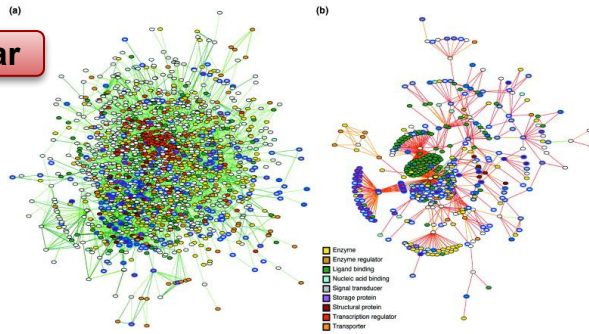
Figures

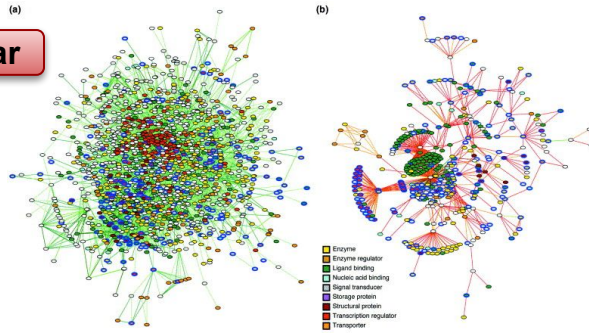Figure 1

Design / Use meaningful figures

- Use **annotations / legends**

- **Briefly describe** figure in the figure caption

- **Figure must be clear** without the text in the paper sections

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Bad Figures

Overloaded / Unclear

Bad Figures

Figure 1. SRQ Plots of T_i/T_n (Vertical Axes) Against i/n (Horizontal Axes) for the Gibbs Sampler (a) and an Alternating Gibbs/Independence Sampler (b) for the Pump Failure Data Based on Runs of Length 5,000. Lines through the origin with unit slope are shown dashed; axis ranges are from 0 to 1 for all axes.

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Bad Figures

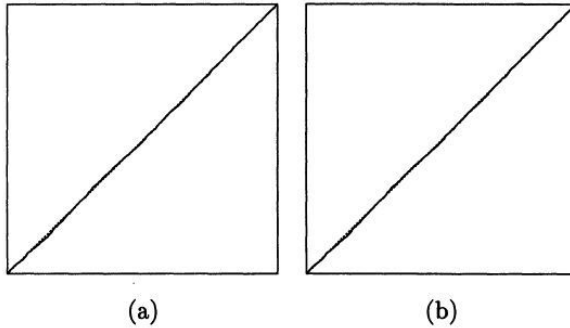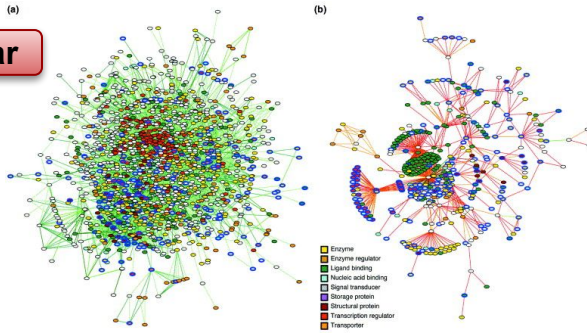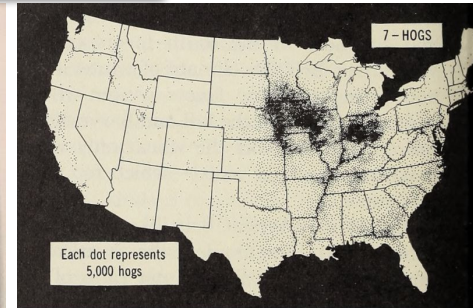Overloaded / Unclear

No information

Not meaningful

Figure 1. SRQ Plots of T_i/T_n (Vertical Axes) Against i/n (Horizontal Axes) for the Gibbs Sampler (a) and an Alternating Gibbs/Independence Sampler (b) for the Pump Failure Data Based on Runs of Length 5,000. Lines through the origin with unit slope are shown dashed; axis ranges are from 0 to 1 for all axes.

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Citing / References

- **Consistent Style**

- Typical reference style: author / date / (paper or book) title, journal

- Type I: **(Author - Year) / [AuthorYEAR]** in text

far. The reasons for this may be both a lack of suitable tools covering the specific needs of the geophysical community and that the available advanced visualization techniques are hardly known in this community (Hibbard et al. 2002; Nocke et al. 2008). Analyses were performed by Macêdo et al. (2000), who explored multivariate ocean–atmosphere datasets using the XGobi software tool (Swayne et al. 1998). In Doleisch et al. (2004), the interactive visual field exploration tool SimVis (Doleisch et al. 2003) was used to visualize a simulated meteorological dataset of the Hurricane Isabel, which struck the U.S. East Coast in 2003. SimVis was then later also applied to climate model data and to reanalysis datasets by Kehrer et al. (2008) and Ladstädter et al. (2009), showing the ability of the tool to explore large climate datasets. Hobbs et al. (2010) showed the benefits

REFERENCES

Aigner, W., S. Miksch, W. Müller, H. Schumann, and C. Tominski, 2008: Visual methods for analyzing time-oriented data. *IEEE Trans. Visualization Comput. Graphics,* **14,** 47–60.

Baldonado, M. Q. W., A. Woodruff, and A. Kuchinsky, 2000: Guidelines for using multiple views in information visualization. *Proc. Workshop on Advanced Visual Interfaces,* Palermo, Italy, ACM, 110–119, doi:10.1145/345513.345271.

Becker, R. A., and W. S. Cleveland, 1987: Brushing scatterplots. *Technometrics,* **29,** 127–142, doi:10.2307/1269768.

Cordero, E. C., and P. M. de Forster, 2006: Stratospheric variability and trends in models used for the IPCC AR4. *Atmos. Chem. Phys.,* **6,** 5369–5380.

Cuntz, N., A. Kolb, M. Leidl, C. R. Salama, and M. Böttinger, 2007: GPU-based dynamic flow visualization for climate research applications. *Simulation und Visualisierung 2007 (SimVis 2007),* SCS Publishing House, 371–384.

de Oliveira, M. C. F., and H. Levkowitz, 2003: From visual data exploration to visual data mining: A survey. *IEEE Trans. Visualization Comput. Graphics,* **9,** 378–394.

Doleisch, H., and H. Hauser, 2002: Smooth brushing for focus + context visualization of simulation data in 3D. *Proc. WSCG,* Plzeň, Czech Republic, Eurographics, 147–154.

The concept was next extended to 3D shapes, yielding a wide family of variations, including surface skeletons [SBTZ02], curve skeletons [CSM07], and centerlines [WLK*02, AB02].

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Citing / References

- Type II: **[Numbered references]** in text

To simulate global shadow effects for real-time rendering, methods computing shadow volumes [2] and deep shadow maps [22], [9] have been presented. These methods sample the volumetric occlusion from the light sources utilizing efficient precomputed data structures. To include scattering effects Ropinski et al. [31] compute a volumetric representation for each light source using a slice-based volume renderer. While these methods are efficient for a single static light source, moving the light source or adding additional light sources require a recomputation of the shadow representation, leading to poor frame rates for dynamic lightning environments.

REFERENCES

[1] K. Beason, J. Grant, D. Banks, B. Futch, and M. Hussaini, "Pre-Computed Illumination for Isosurfaces," *Proc. IST/SPIE Symp. Electronic Imaging*, pp. 98-108, 2006.

[2] U. Behrens and R. Ratering, "Adding Shadows to a Texture-Based Volume Renderer," *Proc. IEEE Symp. Volume Visualization*, pp. 39-46, 1998.

[3] A. Ben-Artzi, K. Egan, F. Durand, and R. Ramamoorthi, "A Precomputed Polynomial Representation for Interactive Brdf Editing with Global Illumination," *ACM Trans. Graphics*, vol. 27, no. 2, pp. 1-13, 2008.

[4] J. Birn, *Digital Lighting and Rendering*, second ed. New Riders, 2006.

[5] P. Desgranges and K. Engel, "Fast Ambient Occlusion for Direct Volume Rendering," US Patent Application 2007/0013696 A1, 2007.

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Adapted Figures / Websites

Figures:

- In caption: *"From Mustermann (1995, Fig. 3)"*

- If figure was altered (in example, arrows were added): *"Adapted from Mustermann (1995, Fig. 3)"*

Online material:

- Websites or online presentations are not peer-reviewed → **not trustful!**

- **No wikipedia!**

- But if necessary, **provide the following information**:

  - Author or editor of web page

  - Title, URL

  - Last modified on … , Accessed on ...

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Common Mistakes

FAKE NEWS!

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Common Mistakes - Paper Format

The general form of your paper is important, even if time is short!

- **Proof-read your submission**

- **Use help of native speakers**

- **Avoid format errors:**
  - even LaTex is not perfect
  - always comply with the given format
  - use line-breaks for long words

Topic of the Paper
Micheal Kren
Seminar
kernm@in.tum.de

Introudction:
This is text with mainy typos This is suddenly a new sentense.
…

Lorem ipsum dolor sit amet, consetetur sadipscing elitr, **sed** diam nonumy eirmod tempor invidunt ut labore et dolore **magna** aliquyam erat, sed diam voluptua. At vero eos et a**ccusam et** justo duo dolores et ea rebum. **THISISALONGSCIENTIFTERM** will be explained in the following.

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Common Mistakes

- **Often much too big** → Do not cover half of your page with one single image

- **Don't waste space** → crop images, use multiple images in one column

- **No meaningful caption:**
  → **always describe the overall content of the image / subimages to help the reader / reviewer**

Figure 1

Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum.

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Common Mistakes - Personal Notes

- **Don't forget to remove every personal note for your final submission**

- **Example paper:** *"Variation in Melanism and Female Preference in Proximate but Ecologically Distinct Environments"*

> ...have ...lfidic ...ange ...these ...: the ...rgent ...ce of ...tions. ...on in ...pula- ...on in ...s and
>
> drainage also gave birth to predominantly melanistic fry in the laboratory (M. Tobler, pers. obs.).
>
> Although association preferences documented in our study theoretically could be a consequence of either mating or shoaling preferences in the different female groups investigated (should we cite the crappy Gabor paper here?), shoaling preferences are unlikely drivers of the documented patterns both because of evidence from previous research and inconsistencies with *a priori* predictions. Our methods closely followed those of published mate choice experiments in this system (Tobler et al. 2009a,b; Plath et al. 2013), and association time is a standard metric of mate

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TODO: what the hell does this mean?
Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet.

Duis autem vel eum iriure dolor in hendrerit in vulputate velit esse molestie consequat, vel illum dolore eu feugiat nulla facilisis at vero eros et accumsan et iusto odio dignissim qui blandit praesent luptatum zzril delenit augue duis dolore te feugait nulla facilisi **(shorten this sentence for the final submission)**

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What we grade

- Scientific type of writing

- Consistent / meaningful structure

- Are your facts replicable / reproducible?

- Comply with our restrictions / layout:

  − **Use ACM Layout (LaTeX)**

  − **6 pages (incl. references)**

- Mark sources / references

- Relate topic to "computer graphics / visualization"

- Content: does your paper contain the key elements / basics?

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Guidelines

1. Is there a **common thread**?

2. Is the **problem exact and clear**?

3. Does the work **answer the most important questions**?

4. Do the **examples support the understanding**?

5. Is there **enough background information** for inexperienced readers?

6. Are the **facts proved** correctly?

7. Is there **redundancy** in the text?

8. Are all **important terms defined** and explained?

9. Do the **captions / section / subsections** correctly represent figures / text sections?

Title of paper

Seminar Topic

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Seminar: Data Visualization

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LaTeX

Simple Tutorial:

- https://www.overleaf.com/latex/learn/free-online-introduction-to-latex-part-1.pdf

- https://www.overleaf.com/latex/learn/free-online-introduction-to-latex-part-2.pdf

Web-Services:

- Sharelatex: https://de.sharelatex.com/

- TUM: https://sharelatex.tum.de

- Overleaf: https://www.overleaf.com/

Wiki:

- https://en.wikibooks.org/wiki/LaTeX

- https://en.wikipedia.org/wiki/Help:Displaying_a_formula

Questions?

Student: I don't understand why my grade was so low. How did I do on my research paper?

Teacher: Actually, you didn't turn in a research paper. You turned in a random assemblage of sentences. In fact, the sentences you apparently kidnapped in the dead of night and forced into this violent and arbitrary plan of yours clearly seemed to be placed on the pages against their will. Reading your paper was like watching unfamiliar, uncomfortable people interacting at a cocktail party that no one wanted to attend in the first place. You didn't submit a research paper. You submitted a hostage situation.

When the deadline is nigh!

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