

## 02830 Project in Digital Media Engineering

Writing scientific papers

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## What is science?

- ▶ Definitions from Feinman's "What Is Science?" (1966):
  - long The result of a discovery that it is worthwhile rechecking by new direct experiments, and not necessarily trusting the experience from the past.
  - short Science is the belief in the ignorance of the experts.
- ▶ From Feinman's "The Uncertainty of Science" (1963):
  1. Science means, sometimes, a special method of finding things out.
  2. Sometimes it means the body of knowledge arising from the things found out.
  3. It may also mean the new things you can do when you have found things out, or the actual doing of new things.
- ▶ Point 3 is the field of **technology**.
- ▶ Technical science is then also point 3, but sometimes mixed with point 1 or 2.

### References

- Feinman, R. P. The Uncertainty of Science. In *The Meaning of It All*, Part I, pp. 1–28. Penguin Books, 1999. Public lecture given in April 1963.
- Feinman, R. P. What Is Science? In *The Pleasure of Finding Things Out*, Chapter 8, pp. 171–188. Penguin Books, 1999. Lecture given to the National Science Teachers' Association in April 1966.

## The scientific paper

- ▶ What is a scientific paper?
  - ▶ Documentation of scientific work.
- ▶ Why do scientific papers exist?
  - ▶ To pass our knowledge on to our descendants.
- ▶ Is a scientific paper required to follow a particular structure?
  - ▶ No, but over the years a practical, recommendable structure has been found.
- ▶ Must a scientific paper be a bore?
  - ▶ Yes... No, rather not!  
It is possible to be precise even if you use an accessible, exciting style of writing.
  - ▶ I recommend a paper by Sand-Jensen [How to write consistently boring scientific literature. *Oikos* 116, pp. 723–727, 2007].
- ▶ Why should report hand-ins be written as scientific papers?
  - ▶ Because practice makes perfect. And when you need to carry out a larger project (theses, articles), you must be aware of the usual structure.

## What is the usual structure of a scientific paper?

- ▶ A typical scientific paper consists of the following sections:
  - .. Title, author name(s), author affiliation(s)
  - .. Abstract
  - 1. Introduction
  - 2. Related work
  - 3. Theory or Method
  - 4. Implementation
  - 5. Results
  - 6. Discussion *and/or* Conclusion
  - .. References
  - .. Appendices
- ▶ Abstract:
  - ▶ A short summary of of the contents of the paper (preferably < 500 words).
- ▶ Related work:
  - ▶ What is known. What did you do that is different.
- ▶ These two sections are rarely used in a report hand-in, but should be used in larger projects.

## The structure of a scientific paper

- ▶ Introduction:
  - ▶ Define and motivate the problem.  
Answer: What is the problem? Why is it interesting?
  - ▶ Describe the objectives of the paper (put forward an hypothesis, if relevant).  
Answer: How do you intend to handle the problem?
- ▶ Theory *or* Method
  - ▶ Describe possible solutions and decide on the best one.
- ▶ Implementation:
  - ▶ Used if the reader needs extra info to implement the theory in practice. Or if a particular algorithm or hardware gives an advantage (speed-up, for example).
- ▶ Results:
  - ▶ Describe the outcome of your efforts (e.g. measured or simulated data, model, formula, algorithm, new comprehension.)
  - ▶ Substantiate the chosen solution, test it, and present the results.

## The structure of a scientific paper

- ▶ Discussion *and/or* Conclusion
  - ▶ Discussion: reflect on theory, implementation and results.
  - ▶ Conclusion: recapitulate how the problem, which was defined in the introduction, was solved in the paper.
  - ▶ Self-criticism is good practice. Assess the quality of your solution.
  - ▶ Describe future work: new applications, improvements.
- ▶ References:
  - ▶ List of *all* the books, articles, papers, web pages, etc. which were used for writing the paper.
  - ▶ There should be a number or other identifier for each reference such that they can easily be referred to in the main text.
  - ▶ Some examples follow on the next slide.
- ▶ Appendices:
  - ▶ Extra details for the reader with a special interest (code, longer derivations, simulated data, enlarged figures, etc.)

## Referencing styles

### Numerical

The Cornell box [2] is a benchmark scene for calculation of diffusely reflected indirect illumination.

#### REFERENCES

- [1] James F. Blinn and Martin E. Newell. Texture and reflection in computer generated images. *Communications of the ACM*, 19(10):542–547, October 1976.
- [2] Cornell University Program of Computer Graphics. *The Cornell Box*. <http://www.graphics.cornell.edu/online/box/>, January 1998. Accessed 25th of August 2004.
- [3] Cyrille Domez, Kirill Dmitriev, and Karol Myszkowski. State of the art in global illumination for interactive applications and high-quality animations. *Computer Graphics Forum*, 22(1):55–77, 2003.

### Author-date

Casein micelles only scatter light and the refractive index is  $\eta_{\text{casein}} = 1.503$  in the visible range [Attai and Richtert 2000].

Data provided by Babin et al. [2003a] have been translated into the volume fractions given here.

### Alphabetical

This special arrangement of the fibrils ensures that they are almost transparent [Ben71].

#### References

- [ASD\*01] ANSARI R. R., SUH K. I., DUNKER S., KITAYA N., SEBAG J.: Quantitative Molecular Characterization of Bovine Vitreous and Lens with Non-invasive Dynamic Light Scattering. *Experimental Eye Research* 73, 6 (2001), 859–866.
- [BC64] BOYNTON R. M., CLARKE F. J. J.: Sources of Entoptic Scatter in the Human Eye. *Journal of the Optical Society of America* 54, 1 (January 1964), 110–119.
- [Ben71] BENEDEK G. B.: Theory of Transparency of the Eye. *Applied Optics* 10, 3 (March 1971), 459–473.
- #### References
- ATTIAE, R., AND RICHTERT, R. L. 2000. Size distribution of fat globules in goat milk. *Journal of Dairy Science* 83, 940–944.
- BABIN, M., MOREL, A., FELL, V. F.-S. F., AND STRAMSKI, D. 2003. Light scattering properties of marine particles in coastal and open ocean waters as related to the particle mass concentration. *Limnology and Oceanography* 48, 2, 843–859.
- BABIN, M., STRAMSKI, D., FERRARI, G. M., CLAUSTRE, H., BRICAUD, A., OBOLENSKY, G., AND HOEFFNER, N. 2003. Variations in the light absorption coefficients of phytoplankton, nonalgal particles, and dissolved organic matter in coastal waters around Europe. *Journal of Geophysical Research* 108, C7,3211 (July), 4–1–20.

## Scientific honesty

- ▶ What is scientific misconduct? [Hansen, V. L. What is scientific misconduct? BioZoom, Vol. 9, Nr. 4, s. 9-14, 2006]
- ▶ FFP-definition (US National Academy of Sciences):
  - ▶ Fabrication: making up results and recording or reporting them.
  - ▶ Falsification: manipulating research, materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.
  - ▶ Plagiarism: the appropriation of another person’s ideas, processes, results, or words without giving appropriate credit.
- ▶ Provide references if something you write comes from elsewhere. Also if you rephrase it.
- ▶ Any non-obvious “statement” must be substantiated by a reference or an explanation. If you “heard it from somewhere”, then find the reference.

## DTU Code of Honour

*"As a student at DTU I am subject to DTU's code of honour for examinations and other academic activity. I accept and support that I am governed by the high standards for accountability and academic and scientific integrity that apply to lecturers, researchers, and students at the university.*

*I therefore show independence in my work and my exam submissions always reflect my own work, without having received unjust oral or written assistance, including by digital means. I know that I must never copy (plagiarize) other people's ideas, thoughts, reports or articles, but I am permitted to quote and refer to them using quotation marks and source references. I also know that I am not allowed to communicate with others during a written exam."*

- ▶ Q&A on "fine or problematic?":  
<https://www.inside.dtu.dk/en/undervisning/regler/aereskodeks/snydscenarier>

## Thesis assessment

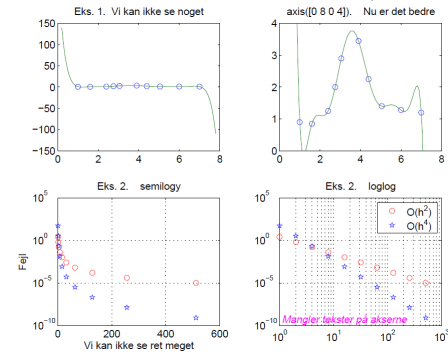
- ▶ Level of difficulty
- ▶ Reproducibility
- ▶ Quality of results
- ▶ Quality of presentation (written and oral)
- ▶ Quality of references

Review of scientific papers often includes assessment of

- ▶ Appropriateness / suitability for publication venue
- ▶ Novelty / originality / justification
- ▶ Significance / importance / magnitude of contribution
- ▶ Reproducibility
- ▶ Technical soundness
- ▶ Quality, depth, and completeness of content
- ▶ Clarity / quality of presentation

## Figures – good advice from the Scientific Computing section

- ▶ Use the scales that best illustrate the relation you are plotting (or graphing) in your paper. Poor examples:



- ▶ A figure (including caption) must be self-explanatory.
- ▶ A simple estimate of the part of the figure area that holds information should be a value close to 1.



Fig. 1. "Congratulations, you are now capable of writing technical, impersonal and boring papers like myself and the other gentlemen – welcome to Academia". Drawing by Sverre Stein Nielsen.

### Reference

Sand-Jensen, Kaj. How to write consistently boring scientific literature. *Oikos* 116(5), pp. 723–727, May 2007.