Writing a Scientific Article, part I

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MINISTRY OF EDUCATION,
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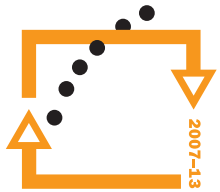

OP Education
for Competitiveness

INVESTMENTS IN EDUCATION DEVELOPMENT

Focus of the Paper

According to the paper type

- Report of some result: improvement, new finding etc.
- Special-issue paper
- Survey paper
- Evaluation/comparison paper
- Short communication or letter
- Opinion paper

→ **Determine the structure and content of the paper**

Focus of the Paper

According to the readers

Learn in advance:

- Conference typical attenders: field of study, profession
- CFP topics $\rightarrow$ include appropriate keywords or *buzz words*
- Expected level of detail: technical vs. shallow (popular)
- Expected volume of evaluation/experimental data
- Expected foundation/justification/strength of ideas
- Expected presentation style: formulas vs. textual description
- Expected presentation style: color graphics vs. plain style

$\rightarrow$ **Determine the structure and content of the paper**

Typical Structure of the (Experimental) Paper

Traditional structure

- *Title*, List of authors, *Abstract*, Keywords
- *Introduction*, sometimes with separated *Related Work*
- Material and Methods
- Results, often with separated *Discussion*
- Often with Conclusion (and Future Work)
- Acknowledgment, List of references

Typical Structure of the (Experimental) Paper

- *Title*, List of authors, *Abstract*, Keywords
- *Introduction*, sometimes with separated *Related Work*
- Results, often with separated *Discussion*
- Material and Methods
  - often with smaller font and limited space
  - often with *many* (=not really limited) supplementary materials
- Often with Conclusion (and Future Work)
- Acknowledgment, List of references

This is the case mainly with biology-touching journal papers.

Hints for Preparing the Paper

- Title, Abstract and Introduction are key sections of any paper.
- Here the reader decides to continue reading or not.
- One must pay extremely good attention to these section.

- Allocate well enough time for writing.
- Revise and rewrite, keep tuning.
- Revise also after a few days again.

- Request revisions from people in your field who are not familiar with your intentions about the content of the paper.
- Request revisions from people from similar fields.

The List of Authors

- Should contain everyone who has contributed to the result
- Not virtually everyone $\rightarrow$ use also the Acknowledgment section
- Include Supervisor? Include head of the lab?
- Consider also funding body
- Affiliations for every author (one or even more)
- Corresponding author
- What order?
- http://www.phdcomics.com/comics/archive.php?comicid=562

The Title

This is the first contact with your paper.

- Should be: describing what the paper is about but still sexy/attractive enough
- Common dilemmas: short vs. long, amusing vs. descriptive

- F. Habibzadeh and M. Yadollahie: Are Shorter Article Titles More Attractive for Citations? Cross-sectional Study of 22 Scientific Journals
- $\rightarrow$ Longer is better in high-impact journals

- I. Sagi, E. Yechiam: Amusing titles in scientific journals and article citation
- $\rightarrow$ Less amusing is better

Here, the reader decides whether to download or not.

The Abstract

This is the second contact with your paper.

- It gives a truthful description of what the paper is presenting
- . . . with a reasonable amount of marketing.

- It contains:
  - Context of the task
  - Task and the motivation to solve it
  - Main result(s)
  - *Cool* facts about the result(s)
- Cool facts = why continue reading
- Cool facts = e.g., why the result is important and better than SOTA

- The publisher often gives a limit on length of the Abstract.
- Preferably, a sentence or two should deal with every item.

Here, the reader hesitates whether to start reading or not.

The Abstract

What is the optimal time for writing the Abstract?

- Perhaps, prepare it as the first thing when several authors should prepare the manuscript.
- It is preferable to have it in advance not to loose the focus of the paper.

- Perhaps, rewrite the Abstract once the manuscript is finished such that it perfectly reflects the content.

- It is allowed to repeat a few sentences from the manuscript in later sections.
- $\rightarrow$ a possible strategy for creating the Abstract

The Keywords

- A short list (3–5 items) of specific but broadly known terms roughly describing the topics studied in the paper.

- It is not very standardized, often takes a free form.
- Sometimes the submission system forces the author to choose from pre-selected list of terms.
- It is mainly useful for the peer-review process.

Some hints:

- ACM Computing Classification system, AMS Mathematics Subject Classification, IEEE EDICS, arXiv.org Classification
- Keywords used in your favorite papers
- Full-text search engines usually do not pay much attention to the list of keywords.

Hints for Preparing the Paper

Top Tips to Make Your Article Discoverable Online

1. **Make sure you have an SEO-friendly title for your article**
   The title needs to be descriptive and must incorporate a key phrase related to your topic. Put your keywords within the first 65 characters of the title.
2. **Carefully craft your abstract using keywords, keywords, keywords**
   a. Choose the appropriate keywords and phrases for your article. Think of a phrase of 2-4 words that a researcher might search on to find your article.
   b. Consider looking up specific keywords on Google Trends or the Google Adwords keywords tool to find out which search terms are popular
   c. Repeat your keywords and phrases **3-4 times** throughout the abstract in a natural, contextual way.
   d. BUT don't go overboard with repetition as search engines may un-index your article as a result.
3. **Provide at least five keywords or phrases in the keywords field**
   Include the keywords and phrases you repeated in your abstract. Provide additional relevant keywords and **synonyms** for those keywords as they relate to your article. Keywords are not only important for SEO, they are also used by abstracting and indexing services as a mechanism to tag research content.
4. **Stay consistent**
   Refer to authors' names and initials in a consistent manner throughout the paper and make sure you're referring to them in the same way they've been referred to in past online publications.
5. **Use headings**
   Headings for the various sections of your article tip off search engines to the structure and content of your article. Incorporate your keywords and phrases in these headings wherever it's appropriate.
6. **Cite your own, or your co-authors, previous publications**
   Cite your previous work as appropriate because citations of your past work factors into how search engines rank your current and future work.

Adapted from:
http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1552-4930/homepage/SEOforAuthorsLINKS.pdf

Based on it, search engines decide where to list your paper.

The Introduction

This is the third contact with your paper.

- Introduces also your writing style, level of English, presentation skills etc.
- Demonstrates your knowledge of the field.
- Aim at leaving a good impression.

- You should:
  - Be straight and efficient
  - Have the text well organized, logical, and fluent
  - Briefly coin the terminology
  - Know the recent development of the field, the cornerstones
  - Identify your contribution w.r.t. the SOTA
  - *Motivate* why to deal with the subject presented
- It is definitely not only just an extended Abstract.

Here, a reader decides whether to continue reading or not.

The Introduction

Typical outline, topics covered:

- Here is an issue in this specific context in this field of study.
- $\rightarrow$ Gives the context and raises a question to be solved.
- The issue is interesting, motivate why it's worth dealing with it.
- Prove it is not completely solved yet: State of the Art (SOTA).
- $\rightarrow$ Might be very brief if a Related Work section is included in the paper explicitly.
- Show your approach, suggest some of the presented ideas.
- Identify the work position w.r.t. the SOTA.
- Even reveal the main achieved result.

The Introduction

Reporting SOTA

- Sometimes a consequent section Related work is required for this.

Introducing the structure of the paper

- Often, the last paragraph is “The rest of the paper is organized as follows. . . ”
- This is not necessarily obligatory, structure is given anyway.
- It should contain real information (avoiding “Results section presents results...”)
- http://www.cs.cmu.edu/~jrs/sins.html

Hints for Reporting the Related Work

Scientist have a big ego.

- Never ever point explicitly at someone's work saying it is bad or stupid.
- Instead, use a polite "sugar wrapping" way.
- $\rightarrow$ Hedging:
  http://en.wikipedia.org/wiki/Hedge_(linguistics)
- $\rightarrow$ (Real) example title:
  „Silence on the relevant literature and errors in implementation"
  http://www.nature.com/nbt/journal/v33/n4/full/nbt.3185.html

- You never know when the person
  - will become a reviewer of your paper,
  - will suddenly become a potential attractive collaborator.

The Materials and Methods

- A precise and complete description of the conditions and procedures used.
- Report using present and past tenses, “we” is used even in single-author papers.
- Again, stick only to the relevant information.
- Sadly, this is where you start shortening when you are over the page limit.
- If granting body does not mind, provide the implementation of solution free of charge.
- $\rightarrow$ Will take time, should be ready when submitting.
- BTW: Some journals require sample implementation and data.

The Resuts

Quantitative results are preferred over qualitative ones.

- Report what and how was measured.
- Report what has been achieved.

- Stick to the standard procedures, standard measures etc.
- It may be considered suspicious to introduce a new measure.
- $\rightarrow$ Often, explaining (and comparing) why a new one is needed requires writing another paper.

- Graphics and visualization are highly appreciated.
- Supplementary material may be Appended (Appendix).

The Results and Discussion

- Take a step back and look at the obtained data.
- Discuss your observations (as objectively as possible).
- Are there any apparent general comments, trends, suggestion to explore in the future?
- Are there any unanswered questions? (This can be a problem, but it is usually appreciated if you are honest).
- Figures should be self-explanatory (via their captions).
- Discussing results is a good opportunity to reference the figures.
- A separated Discussion section is not very usual in computer-science papers.

The Conclusions

- To some extent, it can be a rewritten Abstract with *attenuated motivation* and *emphasized achieved results*.
- Compared to the Abstract, the results can be reported more precisely.
- Unlike in the Abstract, the reader is expected to have already read the whole text.

- Readers, however, often consult Conclusions early to make sure the paper is worth reading.

- Jonathan Shewchuck: "A good conclusion says things that become significant after the paper has been read. A good conclusion gives perspective to sights that haven't yet been seen at the introduction. A conclusion is about the implications of what the reader has learned. Of course, a conclusion is also an excellent place for conjectures, wish lists, and open problems."
- `http://www.cs.cmu.edu/~jrs/sins.html`

The Art of Writing Scientific Papers

Don't get depressed.

It is:

- Difficult to properly line-up logical yet comprehensive outline of the paper
- Tempting to deviate from it while writing
- Difficult to choose convincing arguments given limited amount of pages
- Difficult to present them concisely/economically/efficiently yet clearly
- No surprise if your early-reviewers (supervisor, colleagues) complain too much
- Sometimes the case that additional experiments has to be conducted
- Nothing unusual to rewrite the paper considerably afterwards

The Art of Writing Scientific Papers

Don't get depressed.

It is:

- Nothing unusual if 20 reviewer–author iterations occur
- Typically friends will refuse to read it over and over
- Typically author becomes a reviewer in many iterations

- It may take ages to prepare a good manuscript.
- Even experienced authors have an average of one page per day.