

How to Write a Paper

How to Write a Paper

An Introduction to the Art of Communicating
Ideas and Results in (Computer) Science

Part I

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How to Write a Paper

The Progress of Work in Computer Science A Simplified Picture

1. Work on a (relevant) CS question
2. Write a **scientific paper**
3. Submit the paper to an **appropriate** journal/conference
4. If **accepted** for publication then
 - Add one line to CV
 - Present work at scientific meetings
5. Else (**paper rejected or to be modified**) Go to Step 1

How to Write a Paper

What is a Scientific Paper?

A scientific paper is a written and **pub-
lished** report that describes **original** re-
search results.

Keyword: Primary Publication, i.e.,

- The first publication of original research re-
sults,
- in a form whereby peers of the author(s)
can repeat the experiments and test the
conclusions, and
- in a journal or other source document read-
ily available within the scientific commu-
nity.

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Other types of research reports are, e.g.,

- Technical report (**I/We did it [first]!**),
- Conference paper (**It works, it's neat stuff, and there is more to come!**),
- Conference/meeting reports,
- Textbooks and research monographs.

Are These Primary Publications?

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Why Do People Write Papers?

Idealist: A scientific paper furthers our knowledge of the field. (**Why?**) It is a contribution to the community of our peers.

Realist: My point of view is that “**Our currency is reputation**” (Moshe Vardi at our Research Evaluation Meeting). Good scientific papers are one of the means to increase reputation in our scientific community. Our peers decide the weight of a primary publication.

“I do not remember having felt, as a boy, any passion for mathematics, and such notions as I may have had of the career of a mathematician were far from noble. I thought of mathematics in terms of examinations and scholarships: I wanted to beat other boys, and this seemed to be the way in which I could do so most decisively.” (Godfrey Harold Hardy)

How to Write a Paper

The Three Main Points for us

1. How to **write** a scientific paper
2. How to **present** a scientific paper
3. How to **referee** a scientific paper

Today: **How to write a scientific paper**

“I feel disloyal, but doubtlessly truthful in saying that most scientists do not know how to write.... The only way to learn how to write is above all to read, to study good models, and to practice.” [P. B. Medawar]

How to Write a Paper

How to write a scientific paper

The main message: “The preparation of a scientific paper has almost nothing to do with literary skill. It is a question of **organization**.”
(Robert A. Day, How to Write and Publish a Scientific Paper)

Rule of Thumb: In your presentation, follow a logical progression from problem to solution.

The IMRAD Approach Enforcing the Rule of Thumb

- Introduction
- Methods
- Results And
- Discussion

This approach can/should be used for most forms of expository writing.

How to Write a Paper

Writing a Paper

A scientific paper is written for others to read:

- yourself in the future,
- other researchers, and
- reviewers.

A scientific paper demands exactly the same qualities of thought as are needed for the rest of science: **logic**, **clarity**, and **precision**.

The key to scientific writing is **clarity**.

Organization of a Typical Paper

- Title / list of authors / abstract.
- Introduction / compelling example / related work / overview.
- Development.
- Conclusion (if any).
- Acknowledgments / references.

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The Title

- It should be informative.
- It should be concise.
- It should be catchy / memorable.
- It is best original, but it does **not** need to be funny.

The title is a **label**, not a sentence.

Avoid **abbreviations/jargon**.

Examples of Titles I

Watch out for syntax! Place your title words carefully.

“Multiple Infections Among Newborns Resulting from Implantation with *Staphylococcus aureus* 502A.”

“Preliminary Canine and Clinical Evaluations of a New Antitumor Agent, Streptovitacin.”

“New Color Standard for Biologists”

Robert A. Day

How to Write and Publish a Scientific Paper

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Examples of Titles II

Girard, Jean-Yves. [La mouche dans la bouteille](#). (French) [The fly in the bottle]

Rośtanowski, Andrzej; Shelah, Saharon. [The yellow cake](#).

Robertson, N; Seymour P.D. [Graph Minors I–XVII](#).

Hans Hüttel. [Silence is Golden: Branching Bisimilarity is Decidable for Normed Context-Free Processes](#).

Henzinger, Thomas A. et al. [From pre-historic to post-modern symbolic model checking](#).

L. Aceto, W. J. Fokkink and A. Ingólfssdóttir. [A Menagerie of Non-Finitely Based Process Semantics over BPA*: From Ready Simulation to Completed Traces](#).

On the Temptation of Being Funny

The messenger can hide the message.

Most funny titles do **not** convey concrete messages: they tend to be puns or insiders' jokes.

Do you want to be remembered as the funny one, or for the contents of what you want to say?

Still, the spirit is strong, but the flesh is weak...

The List of Authors

- Alphabetically ordered;
- Ordered by **degrees of contribution**;
- Student first, supervisor second;
- Any other scheme.

Key: The message is more important than (the order of) the messenger(s).

I always use alphabetical order, and that is **not** because my name starts with A!

Ethical Issue on Authorship

An author of a paper should be defined as one who takes intellectual responsibility for the research results being reported.

An author of a paper should be easily reachable for the readers of the contribution.

Always give

- full addresses (physical and email), and
- URLs for web pages.

The Abstract

The abstract should

- be brief (max 250 words);
- state the main objectives and scope of the investigation;
- summarize the results;
- (possibly) state the principal conclusions;
- be updated/written last (to account for the actual contents of the paper).

Fact: Many more people will read your abstract than your paper (e.g., in bibliographic data bases).

Titles, Abstracts and Search Engines

Abstracts are the key to locate papers on the web.

Abstracts are stored textually, so they should **not** contain **formulae**, **special symbols** or **bibliographic references**.

Refrain: “**Our currency is reputation**”
(cf. <http://citeseer.nj.nec.com/cs>)

Example Abstract

This paper shows that the collection of identities which hold in the algebra \mathbf{N} of the natural numbers with constant zero, and binary operations of sum and maximum is not finitely based. Moreover, it is proven that, for every n , the equations in at most n variables that hold in \mathbf{N} do not form an equational basis. As a stepping stone in the proof of these facts, several results of independent interest are obtained. In particular, explicit descriptions of the free algebras in the variety generated by \mathbf{N} are offered. Such descriptions are based upon a geometric characterization of the equations that hold in \mathbf{N} , which also yields that the equational theory of \mathbf{N} is decidable in exponential time.

AMS Subject Classification (1991): 08A70, 03C05, 68Q15, 68Q70.

CR Subject Classification (1991): D.3.1, F.1.1, F.4.1.

Keywords and Phrases: Equational logic, varieties, complete axiomatizations, exponential time complexity.

The Introduction I

A bad beginning makes a bad ending.
(Euripides)

Fact: The introduction often decides the destiny of a paper.

The introduction is often the only part of your paper that will be read.

The introduction should **not** be (too) technical!

The Introduction II

- It should present first, and in all possible clarity, the nature and scope of the problem investigated;
- It should review the related literature to orient the reader;
- It should say clearly what is the achievement of the paper; and
- It should end with an overview of the rest of the paper.

A compelling example is **always** good.

Pitfalls

- Exaggerating.
- Seeking effect for the sake of seeking effect:

“This paper fills a much-needed gap in the literature.” (Ralph Boas in Mathematical Reviews)
- Misspelling (**always** use a spell-checker).

Advice from a Famous Mathematician

“Lesson 9. Write informative introductions Nowadays, reading a mathematics paper from top to bottom is a rare event. If we wish our paper to be read, we had better provide our prospective readers with strong motivation to do so. A lengthy introduction, summarizing the history of the subject, giving everybody his due, and perhaps enticingly outlining the content of the paper in a discursive manner, will go some way towards getting us a couple of readers.” (Gian-Carlo Rota. [Ten Lessons I Wish I Had Been Taught](http://web.media.mit.edu/~cahn/life/gian-carlo-rota-10-lessons.html). Cf. <http://web.media.mit.edu/~cahn/life/gian-carlo-rota-10-lessons.html>)

How to Present Your Results I

- Technical preliminaries and background (to set the scene).
- Progressive development of the material (organized in sections).
- Do **not** be afraid to state where you think that your contribution lies.
- Anticipate, and answer, the possible questions that a reader might have.

The reader might be you at a later date!

How to Present Your Results II

Important! Present your results in as logical a way as possible. If the reader needs A to understand B, then first present A, then B.

Always introduce technical terms **before** using them.

See writing guides for further advice (e.g. Halmos "[How to Write Mathematics](#)"), but common sense suffices for most purposes.

How to Present Your Results III

Use passive tense for work done by others: “it is known”, “it has been done”, etc. However, references should be provided.

Use of passive tense can be avoided by writing, e.g., “Wiles proved Fermat’s Last Theorem [reference]”.

Use active tense for reporting what you have done: “we have found out”, “we have done”, etc.

Note: If you are the only author, we means “the reader and I”.

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Related Work

- Mandatory.
- It situates the novelty and significance of your work, and answers at least the questions:
 - Where do the ideas come from?
 - Have similar ideas been published or proposed earlier?
 - What is really new in the paper?
- **Where?** Either as part of the introduction, or part of the conclusion, or stand-alone section (second or second to last).

Related Work: Pitfalls

- Forgetting or misrepresenting work done by somebody else. (**Dangerous** and unprofessional. Always check your sources very well.)
- Reinventing the wheel.
- Overestimating one's own contribution.

Use of Bibliographical References

Bibliographical references should be used parenthetically, so that they do not interrupt one's reading.

Example: "... as seen in [2]." is not too good, and so is "[KAZAM97] shows that..."

Better: "... as introduced by Church in his monograph on the λ -calculus [2]."

The Conclusion

Option 1: None, as in the mathematical tradition.

Option 2: Minimal

- recapitulates the problem and the contribution;
- assesses the significance of the contribution;
- suggests and outlines future work.

The References

They **must** be impeccable:

- accurate (correct year, place of publication etc.);
- complete (page numbers, etc.).

Always cite the best primary publication for some work.

Standard pitfall: misspelling in titles.

Acknowledgments

Gian-Carlo Rota's lesson 8: Give lavish acknowledgments. (One feels miffed after reading a paper in which one has not been given proper credit.)

Always acknowledge input from your anonymous referees.

Give credit where it is due. It does not cost anything, and it creates friends. Science is more of a social activity than you might think.

How to Write a Paper

The Paper has been Written.
Is the Process over?

No Way! Part of the hard work lies ahead of you:

- Proof-read the paper as carefully as you can.
- Let the paper rest a couple of days, and then proof-read it again.
- Ask other people to read the paper, and be prepared to listen to their comments.

If Happy with the Product,
then Submit the Paper

Credits

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Any infelicity in these slides and in my writings is my own responsibility.