How to Write a Good Paper

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On Writing Well

But if a man legislates on his own, and puts it down in writing, he should revise it a thousand times, if possible.

Maimonides
Crisis and Leadership (circa 1165)

There are those who think that clarity, because it is difficult and rare, should be suspect. The rejection of this view has been the deepest impulse in all my philosophical work.

Bertrand Russell

On Refereeing versus Writing

Perhaps the human brain is so constructed that man was ingenious at seeing others' faults and naive and blind as a child about his own.

Isaac Bashevis Singer
Meshugah (1994)

On Quotations

Don't try to impress the readers with excessive number of quotations.

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(private communication)

Writing Well: Motivation

- Intellectual challenge
- Good for your career
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- First tip:
  View yourself as a small company that will soon be judged by all what it produced

Some General Tips

- Abstract
  - Brief: pure facts
- Introduction
  - Motivation: for a non-specialist
  - Previous work
  - Obtained results
  - Plan of the paper (optional: nobody reads it)

  Tip: write it at the end
- Preliminaries
  - Optional

- Sections
  - of comparable length
  - concentrated around a problem/notion
- Related work
  - Discuss the work of your referees!
- Conclusions
  - Think of a ‘take home message’
- Bibliography
  - don’t dump your BibTeX file!

A Unit

- Definition
- ...
- Definition
- Lemma
- ...
- Lemma
- Theorem
- Corollary

Organization of a Unit

- Introduce the Unit
  Definition
  Give some intuition, perhaps an example
- ...
- Introduce or motivate
  Lemma
- ...
  Summarize if possible
- Theorem
  Explain why interesting
  Clarify the introduced restrictions
- Corollary
  Explain why useful
  Discuss possible applications

Definitions

- Decide which ones should go to Preliminaries
- Various choices are possible
- Backtracking may be needed
- Names matter
- Attention span problem: think of reminders
  (Recall from Section 2 that . . .)

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- Prove lemmas about these notions
- Choose proper notation
- Split too long proofs into lemmas

Organization of a Single Proof

- The proof should flow
  (It is natural to focus first on ...
  Therefore we begin by ...
  Now that we established ... we proceed to prove the main claim.)
- Try to give an intuition
  (The idea is to ...)
- Local definitions welcome
  (But first we introduce the following useful concept)
  (The relevance of the following concept will soon become clear)
- Number only those local conclusions that are needed later
- Don't be afraid to drop obvious cases
  (We limit ourselves to the proof of (3), the only case that is not straightforward.)
- Summarize restrictions
  (Note that the restriction to ... was crucial because ...)

Typical Errors

- No motivation
- Ad hoc notation
- Inconsistent notation
  (for $i = 1 \ldots n$ versus for $1 \leq i \leq n$)
- Badly organized proofs
- Direction of the paper unclear
- Definitions and lemmas unexplained
- Routine proofs given

Single, biggest problem: Combine rigour with clarity

Some Very Well-written Papers

- J.A. Robinson, *A Machine-Oriented Logic Based on the Resolution Principle*, 1965
- E.W.D. Dijkstra, *Cooperating Sequential Processes*, 1968
- S. Cook, *The Complexity of Theorem Proving Procedures*, 1971
- D. S. Scott, *Data Types as Lattices*, 1976
- C.A.R. Hoare, *Communicating Sequential Processes*, 1978

Example 1 (of a green text)

An interesting heuristic remark is that, for every finite set S of clauses which is unsatisfiable and which has a refutation one could possibly construct, there is at least one reasonably small finite subset of the Herbrand universe of S such that $P(S)$ is unsatisfiable and such that P is *minimal* in the sense that $Q(S)$ is satisfiable for each proper subset Q of P. Such a P was called a *proof set* for S in [5]. If only, then, a benevolent and omniscient demon were available who could provide us, in reasonable time, with a proof set P for each unsatisfiable finite set S of clauses that we considered, we could simply arrange to saturate S over P and then extract a suitable refutation of S from the resulting finite unsatisfiable set $P(S)$ of ground clauses. This was in fact the underlying scheme of a computer program reported in [5], in which the part of the demon is played, as best his ingenuity allows, by the mathematician using the program. What is really wanted, to be sure, is a simulation of the proof set demon on the computer; but this would appear, intuitively, to be out of the question.

(J.A. Robinson, *A Machine-Oriented Logic Based on the Resolution Principle*)

Example 2

We consider two sequential processes, "process 1" and "process 2", which for our purposes can be regarded as cyclic. In each cycle a so-called "critical section" occurs, critical in the sense that the processes may have to be constructed in such a way, that at any moment at most one of the two is engaged in its critical section. In order to effectuate this mutual exclusion the two processes have access to a number of common variables. We postulate, that inspecting the present value of such a common variable and assigning a new value to such a common variable are to be regarded as indivisible, noninterfering actions. I.e. when the two processes assign a new value to the same common variable "simultaneously", then the assignments are to be regarded as done the one after the other, the final value of the variable will be one of the two values assigned, but never a "mixture" of the two. Similarly, when one process inspects the value of a common variable "simultaneously" with the assignment to it by the other one, then the first process will find either the old or the new value, but never a mixture.

(E.W.D. Dijkstra, *Cooperating Sequential Processes*)

Example 3

Technically the *To*-hypothesis is what is needed to show that ϵ is one-to-one. The upshot of these two theorems is that in looking for (reasonable) topological structures we can confine attention to the subspaces of $\mathbf{P}\omega$ and to continuous functions defined on *all of* $\mathbf{P}\omega$. Thus the emphasis on a single space is justified structurally. What we shall see in the remainder of this work is that the use of a single space is also justified practically because the required subspaces and functions can be *defined* in very simple ways by a natural method of equations.
In order to make the plan of the work clearer, the proofs of the theorems have been placed in an Appendix when they are more than simple exercises.

(D. S. Scott, *Data Types as Lattices*)

Some Useful Books

- D. Knuth, T.L. Larrabee, P.M. Roberts, *Mathematical Writing*, Mathematical Association of America, 1989
- M.-C. van Leunen, *A Handbook for Scholars*, Oxford University Press, 1992
- J. Zobel, *Writing for Computer Science*, 3rd Edition, Springer, 2015

Good luck with your next paper!

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. . . and thank you for your attention!