Writing Research Articles

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Eighteen fundamental skills of a scientist

1. How does science work?
2. What is research?
3. Identifying good research problems
4. **Writing papers**
5. Presentation in front of an audience
6. Obtaining funding
7. Reviewing/refereeing the work of others
8. Teaching
9. Guiding students, running a lab, managing projects
10. Scientific creativity
11. Information finding
12. Career planning
13. Interacting with people and networking
14. Marketing your skills: job hunt
15. Balancing your life between work and family
16. Coping with stress
17. Ethics in science
18. Appreciation for quality rather than quantity

Overview

- **Why should we bother to write?**
- **Composition of a research article**
- **The process of writing**
- **Concluding remarks**

● **Why do we need to write?**
Composition of a research article
The process of writing
Concluding remarks

Why do we need to write?

- **To let others know about your findings (contribute to the growing body of knowledge about the world).**

- **To expose your work to constructive criticism:**

  This gives you an opportunity to improve your work.

- **To gain recognition for our work:**

  Having our work published proves to our employer (and our future employers), supervisors, and funding agencies that we are dedicated and competent.

Writing your results up closes a typical cycle of investigation

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The difficulty of technical writing

The problem is not easy: we need to summarize in a short paper what is often worth months of work.

And now you have to describe your two years of work on two pages.

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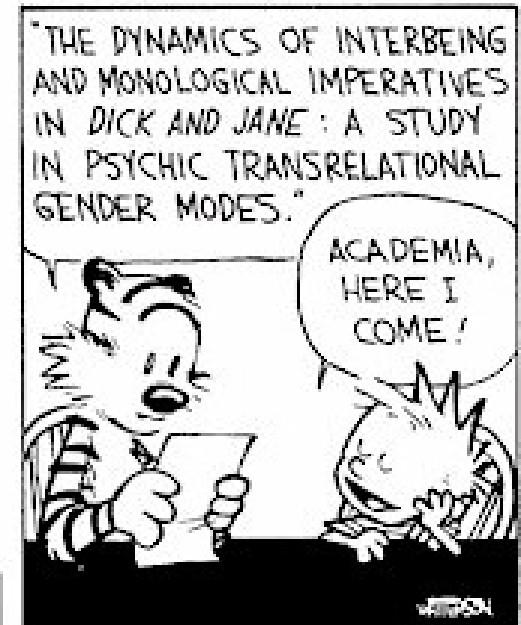**Concluding remarks**
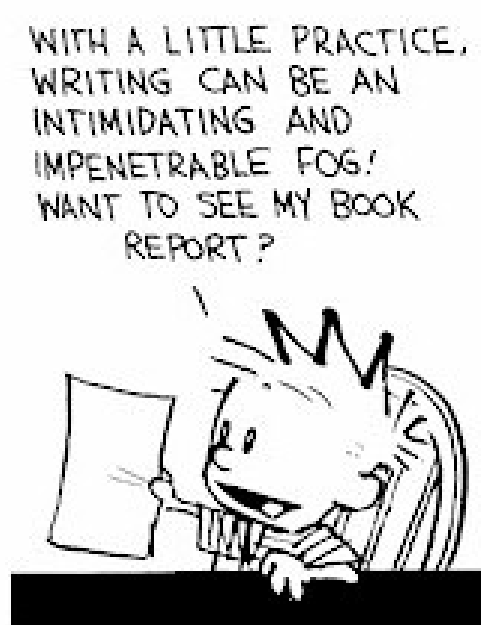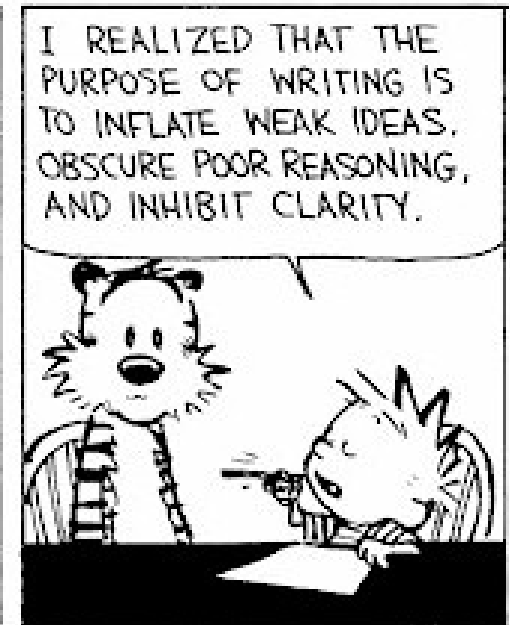
Why do we need to write well?

- **Having a good idea and producing great results is usually not enough – you need to communicate it effectively:** *"If a tree falls in a forest and no one is around to hear it, does it make a sound?"*

- **Many papers are poorly written**

- **Good writing is a skill that we can and should learn**

- **Writing is a skill that is worth learning:**
  - **You will get more credit (in the long run, more funding and more papers accepted)**
  - **Your ideas and results will have more impact**

"Journal of Obscure Research"

**Some papers just belong in the "Journal of Obscure research"
(actually, there is a journal called "Journal of Irreproducible Results"
http://www.jir.com/ ☺)**

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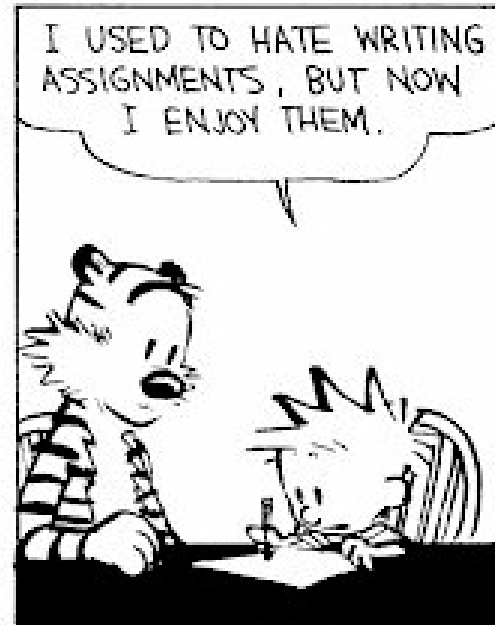
Papers communicate ideas

- **The main purpose of a paper is to communicate an idea.**

- **Make sure that this idea is explicit at the very beginning of your paper and throughout it!**

- **It should be just one good idea (if you have many good ideas, write many papers ☺)**

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How is a scientific paper different from other prose?

Suspense novel:

- **Page 1: It was a stormy night**

- **Page 4: A dead body was found**

- **Page 5: It was a murder!**

- **Page 10: The victim turned out to be Mr. Henry Jones, a prominent landlord in Worcestershire**

- **Page 58: Victim's sister and brother in law had a motive (inheritance), so did the victim's son**

- **Page 128: Sherlock Holmes noticed that the dog did not bark (and, hence, the murderer was an insider)**

- **Page 134: It was the butler**

- **Page 135: The butler hated the victim**

- **Page 135: The end**

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How is a scientific paper different from other prose?

A scientific paper:

- **Abstract: Mr. Henry Jones of Worcestershire was murdered by his butler. The murder was discovered by Sherlock Holmes.**

- **Introduction: Mr. Henry Jones, a prominent landlord in Worcestershire was murdered by his butler. The murder was discovered by Sherlock Holmes. The crucial element of the discovery was noticing that the dog did not bark, hence it must have been an insider.**

- **Middle of the paper: exact time and course of murder, description of the murder weapon, people at whom the dog would not bark, other people who benefitted from the death of the victim, etc.**

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How is a scientific paper different from other prose?

A scientific paper:

- **Methodology and Results: Description of the deduction steps taken by Sherlock Holmes, the role of Dr. Watson, trap set up by Mr. Holmes, catching the murderer, etc.**

- **Discussion: Description of how the observed evidence suggested that it was the butler who did it.**

- **Related work: Similar murders and related work performed by Sherlock Holmes**

- **Conclusion: A brief restatement of everything that is important.**

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How is a scientific paper different from other prose?

There should be no suspense in a scientific paper, at any given point!

(I learned this idea from Dr. Harold Stone when at the IBM Thomas J. Watson Research Center, Yorktown Heights, NY)

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What makes a good research paper?

- **Like any good writing, a research paper has to tell an interesting story.**

- **You are writing for people and you need to make sure that they follow you: Start with the general and/or the familiar and then only proceed with the new ideas and details.**

- **Make sure that your entire paper, including every section and paragraph, is well organized.**

- **Watch your transitions between sections and paragraphs. Make sure that the paper is telling a cohesive story.**

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Narrative flow of a winning research paper

- **Here is a problem**
- **This problem is interesting**
- **This problem is hard and unsolved**
- **Here is my idea**
- **My idea works (support this claim with theoretical proofs or hard data)**
- **Here's how my idea compares to other people's approaches**

That's a good problem!

I wish I knew how to solve it ...

I see how this works. Ingenious!

Your paper

Reader's mind

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Structure of a paper

- **Title (thousands of readers)**
- **Abstract (4 sentences, hundreds of readers)**
- **Introduction (1 page, hundreds of readers)**
- **The problem (1 page, tens of readers)**
- **My idea (2 pages, tens of readers)**
- **The details (5 pages, single readers)**
- **Related work (1-2 pages, tens of readers)**
- **Conclusions and further work (0.5 page, tens of readers)**

Which parts of a paper are the most important ☺?

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Title page

- **Title**

  Choices: very specific vs. general, bold vs. modest

- **Authors:**

  The order is important!

  Who should be included in the list of authors?

- **Affiliations and addresses**

  What do we do with double affiliations?

- **Abstract**

  Tells everything (in as much as you can tell everything in four sentences ☺)

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Abstract

- **The abstract is a brief, standalone summary of your research (often used by conference PC to assign reviewers, by a reader to decide whether to read it, etc.).**
- **Some people write it at the very end, others at the very beginning.**
- **Ideally four sentences, in any case, not more than 2,000 characters!**
- **It should include the following (each 1-2 lines of text):**
  - **Introduction: Background and significance (What is the problem and why it is interesting?)**
  - **Methods and materials: How did you do it and what your solution achieves?**
  - **Results: What have you been able to demonstrate? If possible, quantify your claims.**
  - **Discussion and Conclusions: Why did your approach work so well?**
- **No abbreviations or acronyms, except for really obvious ones (FIFO, USB, GUI, etc.), usually no citations**

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Introduction

- **Typically 1-2 pages**
- **Provide a motivation for the study.**
- **State the nature and scope of the problem**
- **Review the background and the history of prior work (with references).**
- **Describe the problem and your contributions.**
- **Make the reader crave to read more.**

There is generally no "correct" or "best" approach!

Try to develop your own style.

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Introduction: The need for a good story

- **Start with an exposition of the problem.**

- **List approaches to solving the problem (this is really a review of the relevant literature).**

- **Give the people who worked on this problem before you a generous credit! You are "standing on the shoulders of giants," this work would not be possible without them.**

- **Point out that they did not look at the aspect that you are looking at or they did not manage to solve the problem to the end.**

- **Make it obvious that what you are doing is the next logical thing to do.**

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The body of the paper

You need to be very explicit and provide all necessary details!
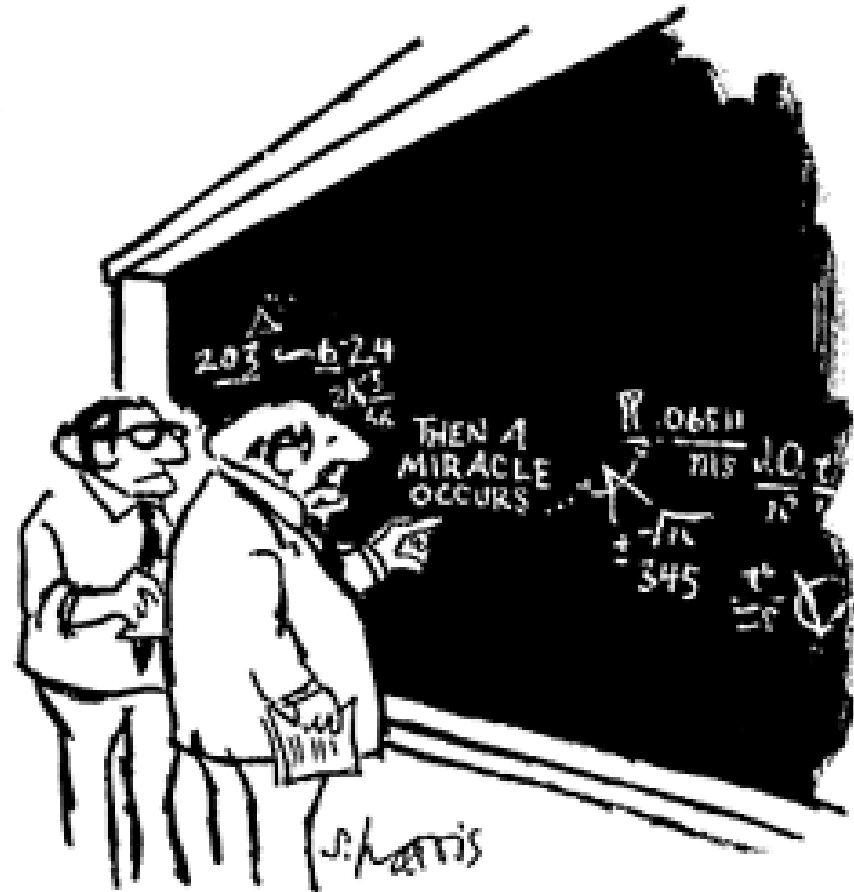
"I think you should be more explicit here in step two."

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The body of the paper

Consider using a "recursive" structure:

- **The first paragraph of every section should set the spirit of the section (by summarizing or reviewing what will follow)**

- **The first sentence of every paragraph should set the spirit of the paragraph (by saying the most important thing)**

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Conveying the idea is important!

- **Explain it as if you were speaking to someone using a whiteboard**

- **Better yet: write as if you were writing to your grandmother** ☺

- **Conveying the intuition is your primary and not secondary goal**

- **Once your reader has the intuition, he/she can follow the details. It is much harder for the reader to develop intuition from the formal details.**

- **Even if he/she skips the details, the reader will still take away something valuable**

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Results

- **Make generous use of tables and figures. The narrative in this section should merely refer to their most important and most interesting elements.**

- **Avoid orphan tables and figures: If something deserves a place in your paper, it certainly deserves a paragraph as well.**

- **Do not confuse results with conclusions! Results are an unbiased outcome of your research.**

- **Report all details (computing platform, processor, operating system, language, compiler version, etc.)**

- **Pay attention to experimental validity of your results.**

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Conclusion / Discussion

- **This is the place for your opinions, guesses, and generally interpretation of your results.**

- **Need to compare your results to similar studies.**
  - **Are your results consistent with the previous results?**
  - **If they are, explain why you think they are different.**

- **If your results are inconclusive, state and discuss this as well.**

- **Outline the avenues for possible future research (remember that every paper is merely a progress report).**

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Conclusion / Discussion

- **Do not claim more than you did, e.g.,**
    - **Do not generalize from one study or result**
    - **Do not claim that because it worked well on a few test cases that it will work well on all test cases, all platforms and for all inputs!**

- **Be modest here and not by using passive voice ☺!**

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Related work

Acknowledging generously contributions of others does not diminish the credit that you will get from your paper

- **Be generous to the competition. "In his inspiring (or seminal, breakthrough, ...) paper Jones (2007) shows ... We follow up his study in the following ways ..."**
- **State clearly in what way your approach is weak.**

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Related work

Failing to give credit to others typically kills your paper

If you imply that an idea is yours and the referee happens to know that it is not yours, then either
- **You do not know that it is an old idea (this is bad)**
- **You know that it is an old idea, but you are pretending that it is your idea (this is very, very bad ☺)**

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Acknowledgments

- **Acknowledge all funding sources (this is why they are giving you money ☺).**

- **Warmly acknowledge people who have helped you, especially if the help consisted of intellectual assistance to you.**

- **Acknowledge reviewers (even if they are anonymous).**

    e.g.,

    "Anonymous reviewers prompted us for more clarity in our exposition."

    "Comments from anonymous reviewers improved the quality of the paper."

    "We would like to thank an anonymous reviewer for pointing out a flaw in the original design of experiment 3."

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References

- **Cite ideas or information from other sources**
  - **In the body of the text [1]**
  - **With complete citation in the references section**

    [1] J. Doe, "The Greatest Paper Ever Written," *Journal of Great Research,* 5(12):155-167, 2001.

- **If possible, use the name/year style,**

  e.g., (Jones 2001)

- **Do not just add citations to your paper because others did! Read the original papers!**

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Final check

Check your paper for the following:

1. **Format requirements (format, number of pages, font, spacing, etc.)**
2. **Do not narrow the margins, reduce line spacing, or use 8pt font,**
3. **Faulty overall structure**
4. **Weak introduction**
5. **Weak conclusion (the paper just stops)**
6. **Excessive wordiness**
7. **Grammar**

Perform lots and lots of rewrites, scrutinize your paper for flow, grammar, word usage, and finally spelling.

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# The visual structure of your paper

- **Give strong visual structure to your paper using**
  - **sections and sub-sections**
  - **bullets**
  - **italics**
  - **nicely formatted algorithm code**
- **Find out how to draw pictures, and use them**

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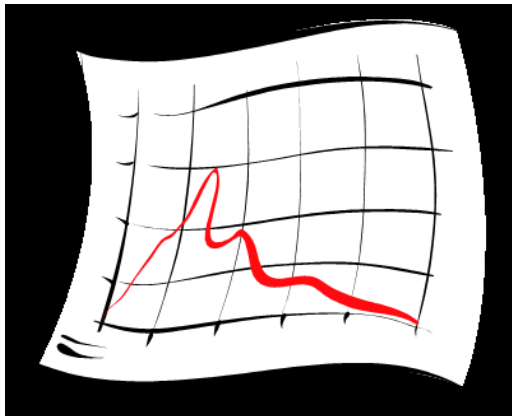
"A picture is worth a thousand words"

- **For a wide variety of data, graphs are more readable than tables**
- **Use graphs and figures whenever possible and appropriate**
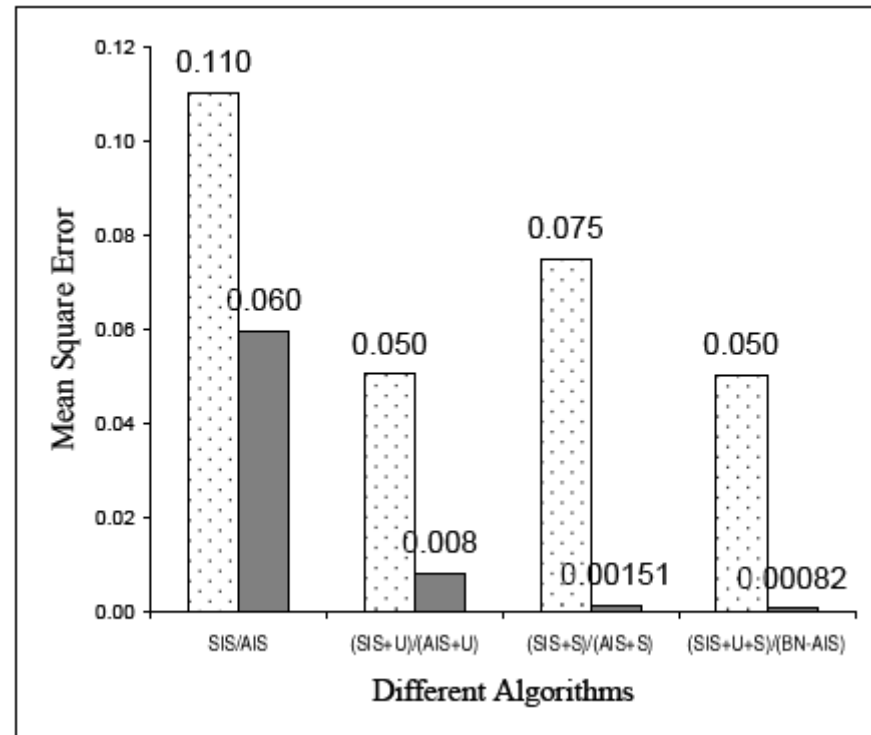
	SIS	AIS	SIS+U	AIS+U	SIS+S	AIS+S	SIS+U+S	AIS-BN
μ	0.110	0.060	0.050	0.0084	0.075	0.0015	0.050	0.00082
σ	0.076	0.049	0.052	0.025	0.074	0.0016	0.059	0.00022
min	0.0016	0.00074	0.0011	0.00058	0.00072	0.00056	0.00086	0.00049
median	0.105	0.045	0.031	0.0014	0.052	0.00087	0.028	0.00078
max	0.316	0.207	0.212	0.208	0.279	0.0085	0.265	0.0018

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Do not use passive voice!

Passive voice may seem "more respectable" and (perhaps) modest but it makes your paper hard to read. My advice is to avoid it whenever possible!

NO	YES
It can be seen that...	**We can see that...**
13 tests were run	**We ran 13 tests**
These properties were thought desirable	**We wanted to keep these properties**
It might be thought that this would be a type error	**You might think this would be a type error**

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Do not use passive voice!

Passive voice is vague ☹

Active voice is both clearer and stronger ☺

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Okropność strony biernej

"W pracy dokonano analizy algorytmu szeregowania …"

Kto dokonał analizy? Antek Pawłów ☺?

Być może pociąga tutaj poetycka wieloznaczność języka polskiego, ale prosze mi wierzyć, ze jest ona jest często tragiczna w skutkach i trzeba ją w publikacjach naukowych z zawziętością tępić!

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Okropność strony biernej

"Ja", "my", czy forma bezosobowa? Aby uniknąć posądzenia o nieskromność autora, zamiast I osoby liczby pojedynczej ((ja) zrobiłem, (ja) zaprojektowałem, (ja) zaprogramowałem, (ja) przetestowałem) przyjęło się używać formy bezosobowej (zrobiono, zaprojektowano, zaprogramowano, przetestowano) lub I osoby liczby mnogiej (zrobiliśmy, zaprojektowaliśmy, zaprogramowaliśmy, przetestowaliśmy). Moim zdaniem najodpowiedniejsza jest forma bezosobowa.

http://www.cs.put.poznan.pl/mdrozdowski/dyd/txt/jak_mgr.html

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Okropność strony biernej

... ale znalazłem również ...

- **Należy unikać sformułowań w pierwszej osobie (zamiast pisać „w pracy przedstawiłem temat ...” lepiej użyć sformułowania „w pracy autor przedstawił temat ...” lub „w pracy przedstawiono temat...”).**
- **Używanie pierwszej osoby jest możliwe dla podkreślenia zadań wykonanych samodzielnie przez autora w ramach tzw. wkładu własnego autora.**

http://www.man.poznan.pl/~jolac/Wskazowki-prace-dyplomowe.doc

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Pluraris maiestatis

W artykule, ktorego autorem jest jedna osoba:

"W eksperymencie dokonaliśmy …"

Z kim autor pracował?

A może autor jest troche niedowartościowany ☺?

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Use of tense

Do not mix tenses

Present tense is stronger than future tense

Past tense can makes the paper read like a diary

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Try not to use abbreviations

Some people say this, others use a lot of them.

I tend to follow the first group (whenever possible ☺).

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Dave Patterson's Writing Advice

http://www.cs.berkeley.edu/~pattrsn/talks/writingtips.html

Read aloud what you have written.
Generally your ear is better than your eyes, and if you read it aloud you are much more likely to find awkward sentences, bad tenses, and other errors.

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Dave Patterson's Writing Advice

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I find many people are good at sentences, but less good at forming paragraphs.
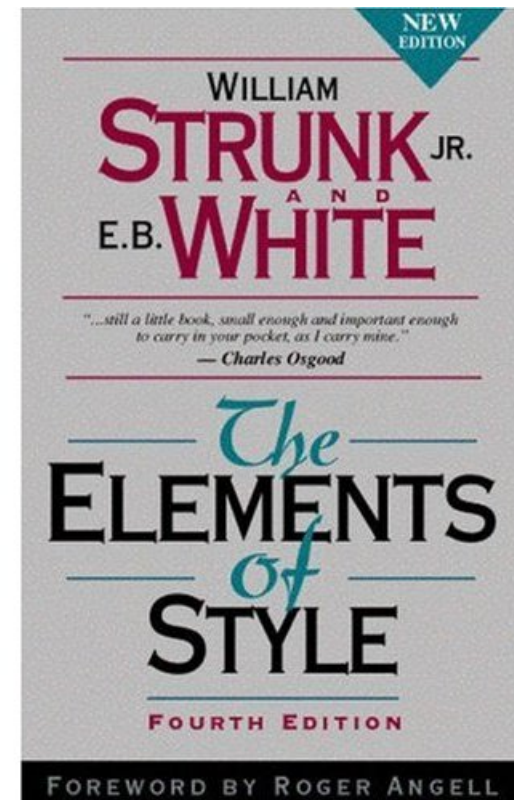Ousterhout has a solid rule, which led me to write shorter paragraphs. **A paragraph is about a single idea, with a single key topic sentence.** This sentence is almost always the first, but sometimes the last sentence of the paragraph, and the rest of the sentences somehow support that topic sentence. If it works, you can get a quick summary of a section just by reading the topic sentences.

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I get most of my specific advice from **Strunk & White**, "Elements of Style," which I call "S&W"
I try to read it every few years to learn things.

The proper citation is *The elements of style*, by William Strunk, Jr.; with revisions, an introduction, and a chapter on writing by E.B. White; [foreword by Roger Angell]. 4th ed. Boston : Allyn and Bacon, c1999. xviii, 105 p.) ed.

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Use automatic checking in document editing software!

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Dave Patterson's Writing Advice: Active Voice, Figures

http://www.cs.berkeley.edu/~pattrsn/talks/writingtips.html

Active voice: (S&W rule 14) For example, use "Figure X shows ..." rather than "... as shown in Figure X."
Also, it is much better to mention a figure that summarizes a lot of information early in a paragraph rather than go into details and mention the figure at the end, as early mention gives the reader a framework to refer to while reading the text.

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Dave Patterson's Writing Advice: "This"

http://www.cs.berkeley.edu/~pattrsn/talks/writingtips.html

Ambiguous use of pronoun "This" to summarize sense of previous sentence. (S&W page 16)
The writing is virtually always clearer if you sane for every occurrence of "This" (case sensitive) or "This is" and put a noun after "This" to make it clear what you are referring to.
I'll find sentences where I'm not really sure what I meant, which must make it harder for the reader!
So search for "This" in your text to see if a noun follows.

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Dave Patterson's Writing Advice:
While instead of *and*, *but*, *although*.

http://www.cs.berkeley.edu/~pattrsn/talks/writingtips.html

**(S&W pages 63-64) In general while should be used only in the strict sense of "during the time time"; S&W give several better ways to convey the same message.
So search for *while* in your text to see if the sentence is about time, or could be replaced with *although*.**

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Dave Patterson's Writing Advice: A single-numbered subsection

http://www.cs.berkeley.edu/~pattrsn/talks/writingtips.html

It is **strange to have a single subsection** (e.g., 5.2.1 in section 5.2). Why do you need to number it if there is only one? Either eliminate the single subsection, or change the part that precedes the subsection into a second subsection.

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Dave Patterson's Writing Advice: Refering to Chapters, Figures, Tables

http://www.cs.berkeley.edu/~pattrsn/talks/writingtips.html

It is not an easy to understand rule, but normally these names are capitalized when used to refer to a specific number.
So it is Chapter 1, Table 3.1, Figure 1.2.
I have seen some people not capitalize section 1, but I don't understand the logic behind it, so I'd capitalize it also.

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Dave Patterson's Writing Advice: Labeling in Tables

http://www.cs.berkeley.edu/~pattrsn/talks/writingtips.html

Label percentages in tables with %, dollars in tables with $.
It is much easier to look at a list of numbers that are percentages and immediately realize that it is a column of percentages if every number has a % after it, vs. just labeling the column as Percent.
No one will be confused that this is percent of a percent of if you do both. Similar argument holds for prices and $.

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Dave Patterson's Writing Advice: Numerals

http://www.cs.berkeley.edu/~pattrsn/talks/writingtips.html

The general rule of thumb is to spell out one to ten and use numbers for numbers for 11 and up.

However, it may be better to consistently use numbers when the reader might naturally compare or do arithmetic with the numbers with a sentence or a paragraph.
The 8-processor case (model 370) needs only 4 computers to hold 32 processors.
Blindly following the rule of thumb would change the sentence to
The eight-processor case (model 370) needs only four computers to hold 32 processors.

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Use simple, direct language

NO

YES

The object under study was displaced horizontally

The ball moved sideways

On an annual basis

Yearly

Endeavour to ascertain

Find out

It could be considered that the speed of storage reclamation left something to be desired

The garbage collector was really slow

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Avoid useless words

"Very," "actually," "easily," "truly," "in fact," "some," etc.

They add nothing to the text, so leave them out

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"Deadwood phrases"

http://www.klariti.com/technical-writing/Deadwood%20Phrases.shtml

a majority of	$\Rightarrow$ most
a sufficient amount of	$\Rightarrow$ enough
according to our data	$\Rightarrow$ we find
accordingly	$\Rightarrow$ therefore, so
after the conclusion of	$\Rightarrow$ after
along the lines of	$\Rightarrow$ like
as is the case	$\Rightarrow$ as is true
ascertain the location of	$\Rightarrow$ find
at such time as	$\Rightarrow$ when
at the present time	$\Rightarrow$ now
at this point in time	$\Rightarrow$ now

Why do we need to write?
● Composition of a research article
The process of writing
Concluding remarks

"Deadwood phrases"

http://www.klariti.com/technical-writing/Deadwood%20Phrases.shtml

be deficient in	$\Rightarrow$ lack
be in a position to	$\Rightarrow$ can, be able
by a factor of two	$\Rightarrow$ two times, double, twice
by means of	$\Rightarrow$ by
come to a conclusion	$\Rightarrow$ conclude
despite the fact that	$\Rightarrow$ although
due to the fact that	$\Rightarrow$ because
during the time that	$\Rightarrow$ while
equally as well	$\Rightarrow$ as well, equally well
fewer in number	$\Rightarrow$ fewer

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for the purpose of	⇒ to, for
for the reason that	⇒ because
for this reason	⇒ thus, therefore
give consideration to	⇒ consider, examine
give indication of	⇒ show, indicate, suggest
happen(s) to be	⇒ am/is/are
has been proved to be	⇒ is
if conditions are such that	⇒ if
in a number of	⇒ several, many
in all cases	⇒ always
in case	⇒ if
in close proximity to	⇒ near

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in excess of	$\Rightarrow$ more than
in large measure	$\Rightarrow$ largely
in many cases	$\Rightarrow$ often
in most cases	$\Rightarrow$ usually
in no case	$\Rightarrow$ never
in order that	$\Rightarrow$ so that
in order to	$\Rightarrow$ to
in some cases	$\Rightarrow$ sometimes
in terms of	$\Rightarrow$ in
in the amount of	$\Rightarrow$ for
in the case of	$\Rightarrow$ for
in the event that	$\Rightarrow$ if

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in the field of	$\Rightarrow$ in
in the near future	$\Rightarrow$ soon
in the neighborhood of	$\Rightarrow$ near, about, nearly
in the vicinity of	$\Rightarrow$ near
in this case	$\Rightarrow$ here
in view of the fact that	$\Rightarrow$ because, since
is capable of	$\Rightarrow$ can
is found to be	$\Rightarrow$ is
is in a position to	$\Rightarrow$ can

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it has been found that	$\Rightarrow$ **(nothing)**
it has long been known that	$\Rightarrow$ **(nothing)**
it is a fact that	$\Rightarrow$ **(nothing)**
it is evident that	$\Rightarrow$ **(nothing)**
it is interesting to note that	$\Rightarrow$ **note that**
it is noted that	$\Rightarrow$ **(nothing)**
it is our opinion that	$\Rightarrow$ **we think**
it is possible that	$\Rightarrow$ **perhaps**
it is well known that	$\Rightarrow$ **(nothing)**
it may be said that	$\Rightarrow$ **(nothing)**

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make inquiry regarding	⇒ ask about, inquire about
manner in which	⇒ how
not with standing the fact that	⇒ although
on the basis of	⇒ from, because, by
on the order of	⇒ about, approximately
present in greater abundance	⇒ more abundant
prior to	⇒ before
provided that	⇒ if
put an end to	⇒ end
reach a conclusion	⇒ conclude
serves the function of being	⇒ is

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subsequent to	⇒ after
the question as to	⇒ whether
there can be little doubt that	⇒ probably
utilize or utilization	⇒ use
with reference to	⇒ about
with the exception that	⇒ except that

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Useful links

http://www-2.cs.cmu.edu/afs/cs.cmu.edu/user/mleone/web/how-to.html

http://www.wit.at/events/peyton-jones/writing_a_paper.rm

http://www.cs.ucr.edu/~michalis/TECHWRITING/structure.html

Why do we need to write?
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The process of writing

- **Start AEAP (As Early As Possible ☺).**
  - **Papers written the few nights before the deadline get typically rejected.**
  - **Papers need time to mature (like wine and cheese).**
- **Collaborating with other scientists will provide motivation and increase your productivity.**

Why do we need to write?
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The process of writing: Getting help

Get your paper read by as many friendly reviewers as possible

- **Experts are great.**

- **Non-experts are also very good.**

- **Each reader can only read your paper for the first time once, so use your readers wisely.**

- **Ask for high-level structural comments (generally, "I got lost here" or "this seems wrong" are more important than corrections of spelling errors).**

Why do we need to write?
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The process of writing: Getting help

- **When you think that you are done, send your draft to the competition and ask them for feedback.**

- **How do you encourage them to look at your paper? Something like "could you help me ensure that I describe your work fairly?" will get their attention.**

- **Often they will respond with helpful critique (they are interested in the area). Of course, they will also make sure that you acknowledge their work fairly (or more than fairly ☺).**

- **They may end up being reviewers of your paper anyway, so getting their comments or criticism early is a good idea.**

Why do we need to write?
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Handling reviews

Treat every review like gold dust

Be (truly) grateful for criticism (if you are a human you will be automatically/unconsciously grateful for praises ☺)

This is very hard

But it is

very, **important**

Why do we need to write?
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Listening to your reviewers

- **Read every criticism as a positive suggestion.**

- **Even if you disagree with the remarks, view them as a prompt to explain your ideas more clearly.**

- **Do not even think of responding "You are stupid. How could one understand it this way? I meant X.". Fix the paper so that X is apparent even to the most cognitively challenged reader.**

- **Thank the reviewers warmly. They have donated their time to your cause.**

Why do we need to write?
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Typical "deadly" faults of rejected papers

- **Not reviewing prior work**

- **Not comparing with the "competition"**

- **Not explaining the scope, novelty, and importance of the work**

- **Carelessness: unfounded assumptions, arbitrary and unmotivated choices**

- **Too weak or too strong claims ("I propose an algorithm" vs. "I propose an algorithm that solves everything" vs. "I propose an algorithms that improves the state of the art algorithm by 35%")**

Why do we need to write?
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Need local help with editing/proofreading?

I have no financial or any other interest in advertizing Ms. Humienik-Dworakowska. I just think that people doing good work should be recommended.

Urszula Humienik-Dworakowska
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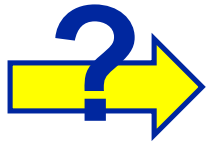**tel. 085 67 47 803**
art.factory.bialystok@gmail.com
http://theworkshop.wordpress.com/
http://miasta.gazeta.pl/bialystok/1,35251,5194400.html
http://www.poranny.pl/apps/pbcs.dll/article?AID=/200
80712/WKL01/620527119

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Why do we need to write?
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Concluding remarks

- **Identify the key idea.**

- **Make your contributions clear and explicit.**

- **Do not mix conclusions with the results.**

- **Use examples.**

- **Write clearly, use simple language, use the first person ("I" or "we" if multiple authors).**

- **Label and explain graphs and tables properly – if they were worth to place in the paper, they deserve some guidance in the text.**

- **Proofread, spell check, and polish your paper.**

- **Ask your colleagues and mentors to read your paper, consider their advice!**

- **Choose a strategy that works for you best (top-down, bottom-up, or mixed).**

Eighteen fundamental skills of a scientist

Next week

?

1. How does science work?
2. What is research?
3. Identifying good research problems
4. Writing papers
5. **Presentation in front of an audience**
6. Obtaining funding
7. Reviewing/refereeing the work of others
8. Teaching
9. Guiding students, running a lab, managing projects
10. Scientific creativity
11. Information finding
12. Career planning
13. Interacting with people and networking
14. Marketing your skills: job hunt
15. Balancing your life between work and family
16. Coping with stress
17. Ethics in science
18. Appreciation for quality rather than quantity