Scientific Writing
The Computer Science Perspective

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### Scientific Presentation and Conduct

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Make every possible effort to improve your writing.

Papers are the longest lasting artifacts that a scientist produces.

You want your papers to be read, but you cannot expect the reader to make an effort that you, as the writer, are not willing to make.
Part A: Principles of composition
Part B: How to organize a paper
1. Choose a suitable design and hold to it.

Planning must be a deliberate prelude to writing.

Start from a skeleton:
definitions, theorems, results, examples, etc.
Then fill in the text.
2. Make the paragraph the unit of composition.

Begin each paragraph with a sentence that suggests the topic of the paragraph.

Deliberately choose the order of sentences within a paragraph, and the order of paragraphs within a section.
3. Write with nouns and verbs, not with adjectives and adverbs.

Select your nouns and verbs carefully.
No spicy adjective can save a bland noun.

Use a thesaurus.
4. Omit needless words.

A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, a section no unnecessary paragraphs.

*the fact that I had arrived*  *my arrival*

Avoid the use of qualifiers.

*We should all try to do a little better, we should all be very watchful of this rule, for it is a rather important one and we are quite sure to violate it now and then.*
5. Use definite, specific, concrete language.

Prefer the specific to the general, the definite to the vague, the concrete to the abstract. Commit, don’t hesitate.

A period of unfavorable weather set in.  It rained every day for a week.

This is perhaps the most important rule to keep the attention of the reader.
6. Use the active voice.

Active voice is more direct, more vigorous, and more concise.

There were a great number of dead leaves lying on the ground.  The ground was covered by dead leaves.  Dead leaves covered the ground.

In scientific writing use “we” to mean “the writer(s) and the reader together.”

Put statements in positive form.

He was not very often on time.  He usually came late.
7. Be clear.

When you become hopelessly mired in a sentence, start fresh. Usually what is wrong is that the construction has become too involved and the sentence needs to be broken apart.

Never take shortcuts at the cost of clarity.
Never use undefined abbreviations.

Avoid ambiguous pronouns (this, it).
8. Keep related words together.

The relative pronoun should come immediately after its antecedent.
Modifiers should come next to the word they modify.

There was a stir in the audience that suggested disapproval.
A stir that suggested disapproval swept the audience.

He only found two mistakes.
He found only two mistakes.

Relative pronouns: “that” is restrictive, “which” is not.
9. Introduce names for clarity and emphasis.

Everything - conditions, ideas, relationships - can be named. Referring to a concept by name increases precision (and saves space).
10. Be consistent with designators.

Always use the same word(s) to refer to the same thing. Variation confuses the reader.

Express parallel ideas in similar form. The likeness of form helps the reader to recognize the likeness of content and function.

Formerly, science was taught by the textbook method, while now the laboratory method is employed.

Formerly, science was taught by the textbook method; now it is taught by the laboratory method.
11. Keep to one use of tenses.

Avoid forward references.

Previews and summaries are useful only if they are more than lists or repetitions.
12. Place yourself in the background.

Draw the reader’s attention to the substance of the writing, rather than to the temper of the writer.

Clearly separate fact from opinion.
13. Do not overwrite.

Prefer the standard to the offbeat, the simple to the pretentious. Ornate language is hard to digest and nauseating.

Avoid fancy words and cliches.
Use foreign languages and figures of speech sparingly.
Do not be tempted by the cute.

Use *italics* and exclamation marks infrequently and judiciously.
14. Do not overstate.

When you overstate, the reader will be instantly on guard, and everything that has preceded your overstatement as well as everything that follows it will be suspect in his mind.

A single carefree superlative has the power to destroy, for the reader, the object of the writer’s enthusiasm.
15. Some common errors of English usage:

In a series of three or more terms, use a comma after each term except the last.
Enclose parenthetical expressions between commas or dashes.
Join independent clauses by semicolons.
Put periods and commas inside quotation marks even if they are not part of the quote.

Hyphenate words that combine to form a compound adjective.

Spell out numbers up to ten, except in dates and serial numbers.
Never start a sentence with a digit or symbol.

Avoid colloquialisms (don’t).
16. Revise and rewrite, again and again.

A pencil is the most useful tool for shortening. For rearranging a text, scissors should be brought into play.

Do not be afraid to throw away what you have written.
Homework 1:

Choose a text you have written, between 500 and 1000 words.

Go through it paragraph by paragraph, sentence by sentence, word by word, and apply all 16 principles of composition.

What is the percentage of words saved?
Peyton-Jones: How to write a great research paper

I used to hate writing assignments, but now I enjoy them.

I realized that the purpose of writing is to inflate weak ideas, obscure poor reasoning, and inhibit clarity.

With a little practice, writing can be an intimidating and impenetrable fog. Want to see my book report?

"The dynamics of interbeing and monological imperatives in Dick and Jane: a study in psychic transrelational gender modes."

Academia, here I come!
Wrong: We write papers to impress others, gain recognition, and get promoted.

Right: We write papers to communicate ideas and report findings.

The goal is to infect the mind of the reader with your idea, like a virus.
Wrong: Idea ⇒ Do research ⇒ Write paper

Right: Idea ⇒ Write paper ⇒ Do research

Focuses the research.
Opens the dialogue with others (critique and collaboration).

Writing the paper is how you develop the idea in the first place.
It usually turns out to be more interesting and challenging than it seemed at first.
How To Convey Your Idea

• Here is the problem.
• It’s an interesting problem.
• It’s an unsolved problem.

• Here is my idea.

• My idea works (details, data).
• My idea differs from other people’s ideas.
• This is what follows from my idea.
The Introduction

1. Introduce the problem with a carefully chosen example.
2. State your contributions.

Draft the introduction first, rewrite it last:
The list of contributions drives the paper;
the paper substantiates the claims made in the introduction.

The reader should think “Gosh, if they can really deliver this,
that would be exciting – I better read on.”
Introduction Part 1: The Example

Your primary goal is to convey the intuition: Explain the problem as if you were using a whiteboard; once the reader has the intuition, she can follow the details (but not vice versa).

Even if the reader skips the details, she still takes away something valuable.
Introduction Part 2: The Contributions

Don’t leave the reader to guess what your contributions are. Some reviewers will guess wrong.

Don’t have too many contributions.
Some reviewers will focus on the weakest contribution.

Contributions must be specific and refutable.

We describe the WizWoz system and study its properties. It is really cool.

We give a type system for a language that supports concurrent processes. We prove that type checking is decidable.
The Details

The introduction makes claims; the body of the paper provides evidence to support each claim.

Evidence can be theorems or measurements. Theorems need proof; measurements need to be repeatable.

Supporting evidence (proofs, data) can be supplied in appendices or on the web.
The Appearance

Give strong visual structure to your paper (subsections, bullet lists, figures).

Give meaningful names to (sub)sections, paragraphs, theorems, examples, figures, etc. Some readers will skip everything else.
Comparison with Related Work

1. Be specific (make sure your comparison is accurate).
2. Be honest (acknowledge weaknesses of your approach).
3. Give credit (be generous to the competition).

Wrong: To make your work look good, you have to make other people's work look bad.

Right: Giving credit to others does not diminish the credit you get for your work.
The Bibliography

References are parenthetical; they are not part of the sentence.

Give a reference where an intellectual debt is due. Don’t give a reference for any other reason.

Be consistent in style! The quickest check of how much care has gone into a paper is to take a look at the bibliography.
The Conclusion

Don’t just summarize – add something new.

This is the place to bring in some opinion: identify the key insight(s), evaluate/judge the results, consider the ramifications/applications, speculate about the next steps.
The Abstract

Be brief, precise, and factual:

Sentence 1: the problem.
Sentence 2: the solution.
Sentence 3: the consequences.

Write the abstract last and choose each word carefully. The fewer words you have to describe something, the more difficult it is.
Getting Help

Start early – hastily written papers get rejected.
Good papers are like wine: they need time to mature.

Get your paper read by as many friendly guinea pigs as possible:
Experts are good; non-experts are also good.
If a reader does not understand something, the blame is always on the writer.

Each reader can only read your paper for the first time once – so use them judiciously!

Warmly acknowledge all help you got.
Drawing the Competition to Your Side

When you think you are done, send a draft to competitors saying “Could you please help me ensure that I describe your work fairly?”

Often they will respond with feedback. Be grateful for criticism as well as praise and be prepared to listen – even if it is (really) hard!

They are likely to be your referees anyway, so getting their comments up front is an unbelievable deal.
If you remember nothing else …

- Identify your key idea.
- State your contributions explicitly.
- Use examples to give intuition.
- Write in simple, direct language.
If you remember nothing else ...

• Identify your key idea.
• State your contributions explicitly.
• Use examples to give intuition.
• Write in simple, direct language.

And above all,
try to have fun writing!
(It will show.)