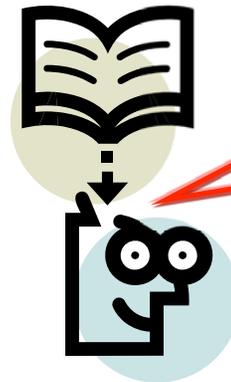


Writing a Research Paper

Ashok Srinivasan
Florida State University
asriniva@cs.fsu.edu



This paper is not
as terrible as the
other junk that I
reviewed



We are honored
to receive such
praise from the
all-knowing one

Author

How to impress Prof. Skeptic, the reviewer

Outline

- Common mistakes
- The writing process
- Organizing the contents

Common Mistakes

- Plagiarism
- Passive voice
- Typographical errors
- Not explaining your contribution
- Inconsistent results
- Style over substance

Plagiarism

- Do not steal others' ...
 - Ideas
 - Words
 - Rewrite others' material in your own words, when necessary, and cite the reference
 - Citing a reference does not justify using its words
 - If you must use a short quote from elsewhere, then make it clear by putting it in quotes, and perhaps writing it in italics
 - Cite the reference too
 - Avoid quoting as far as possible
 - Figures
 - Just because it is easy does not make it right
- You can recover from a reputation as a bad researcher more easily than from a reputation of being dishonest

Self Plagiarism

- Don't submit work you have already published
 - If you made improvements to prior work, then clearly identify them in the paper and cite the earlier work
 - Identify any result in the current paper that has already been published
- Don't submit to two venues simultaneously
 - Most conferences and journals prohibit this
 - It may be ok to do this for poster sessions and venues, such as most SIAM conferences, which require just abstracts
 - Ask the program chair, if you have any doubts
- It may be ok to reuse figures and some background material from **your own** prior work
 - But beware of copyright issues

Passive Voice

- Let passive voice be avoided
 - ... better: 'Avoid using passive voice'
- In judging a paper, it is important for the reviewer to know what you did versus what someone else has done
 - Passive voice makes it easy to avoid mentioning the doer
 - Example: 'The effect of affinity on network bandwidth utilization was studied'
 - Studied by whom?
 - If you studied it, then claim the credit
 - 'We studied the effect of affinity on network bandwidth utilization'
 - If others did, then give them the credit
 - 'Sudheer et. al. [3] studied the effect of affinity on network bandwidth utilization'
- Passive voice is also harder to understand

Typographical Errors

- Typographical errors create a bad impression
 - The reviewer may not explicitly reject a paper because of typographical errors, but may sub-consciously decide to reject it
 - Once the reviewer decides to reject a paper, it is very easy for him to come up with technical reasons for rejecting it
 - Reviewers have a heavy work load and would love a paper that is a clear reject, so that they can save themselves some time
 - Don't tempt them with your typographical errors
- It is a sin to have spelling mistakes that could be caught by a spell checker
 - Always spell check the final version to catch errors you might have introduced while correcting an error
- References too should be free of typographical errors
 - Beware of capitalization errors when using bibtex

More typographical Errors

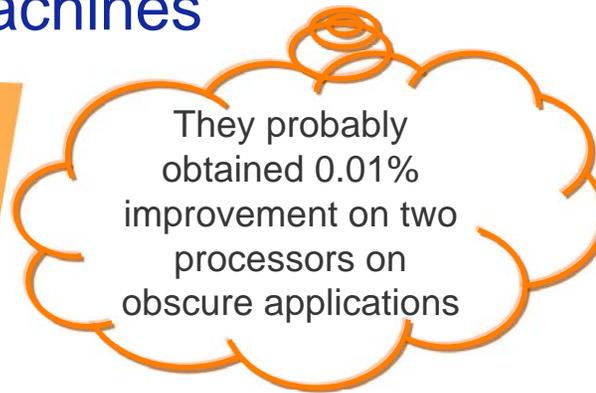
- Use consistent formatting.
- Common typographical errors
 - Extra blank spaces
 - Missing blank spaces
 - Capitalization errors
- Can you identify three typographical errors on this slide?

Not Explaining Your Contribution

- Clearly identify your contribution
 - Mention related work by others
 - Mention your related prior work
 - Mention what is new about your current work
 - How does it differ from the above two categories?
 - Under what conditions is your method better?

Explain Your Contribution

- Quantify the significance of your work if possible
 - Example: You write -- ‘We obtained much better speedup than [3,4] on practical applications on massively parallel machines’



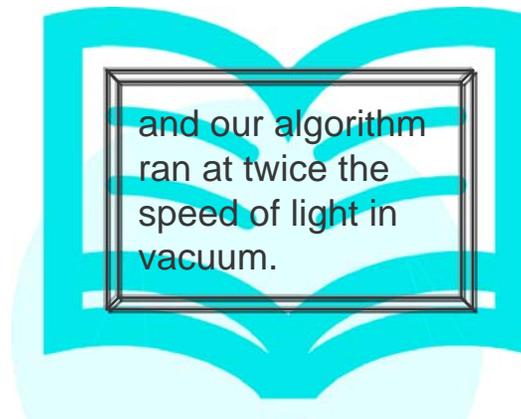
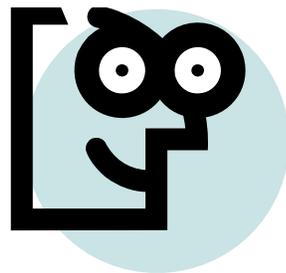
- Write: ‘We obtained 20-30% greater speedup than [3,4] on all HPC Challenge benchmarks on a 1000 processor Xeon cluster’

Inconsistent Results

- Ensure that your results don't contradict each other
 - For example, speedup results should be consistent with timing results
 - Timing results for components of your computation should be consistent with timings for the total computation
 - Ensure that your timer has sufficient resolution for the timing that you are performing

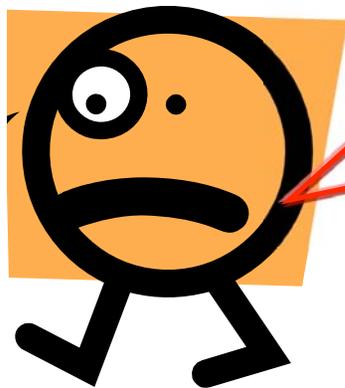
Unreasonable Results

- Ensure that your results don't contradict theoretical bounds
 - For example, the Gflop/s you obtain cannot exceed the peak performance of the machine that you are using
 - Check your results to make sure that they are reasonable

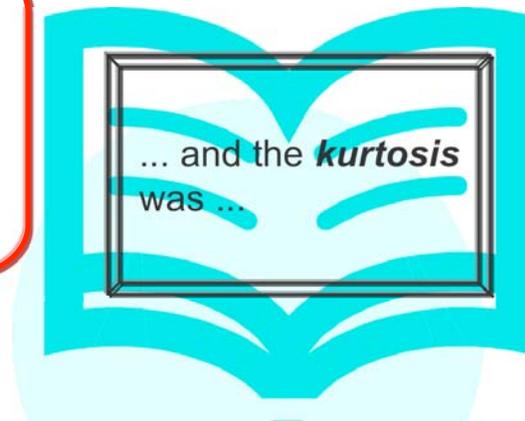


Style Over Substance

- Great language cannot compensate for poor science
 - Use simple, clear language
 - If the reviewer can understand what you have done and why it is important, you have achieved more than most manuscripts do



What a terrible disease. I hope I can't get infected by reading about it.



Style Over Substance 2

- Don't praise your work too much
 - The reviewer should praise your work
 - You should explain your work and present results that make the reviewer praise your work

Paper Rating	
1	Weak accept
0	Borderline
-1	Reject
-2	Reject with deep contempt X
-3	Reject with public ridicule



I am God's greatest gift to humanity. How dare they make false claims.

... and our work is God's greatest gift to humanity.

Style Over Substance 3

- Don't exaggerate the significance of your work
 - It may just irritate the reviewer
 - It is ok to make your work sound exciting
 - You would not be writing about it if you did not find it exciting
 - But, a nice idea does not become 'a new paradigm'
 - A nice result does not become a 'breakthrough'

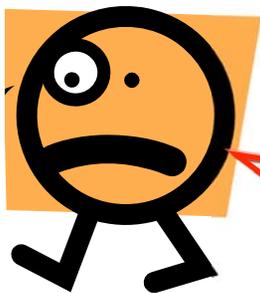


It looks like they plan to revive the sun dial.

Our solar clock promises to change the course of humanity by eliminating toxic waste, reducing ...

More on Writing Style

- Avoid technical jargon and explain any that you need to use
 - *If the reviewer does not understand your paper, then he will not accept it*
 - Don't assume that the reviewer has expertise on the specific problem on which you have been working
 - You cannot make your work sound profound by making it hard to understand
 - You just show poor writing skill!



I don't understand this paper. Either I am not the greatest genius the world has ever seen, or this paper is too badly written to be accepted.

What will Prof. Skeptic do?

The Writing Process

- Why are you writing this paper?
- The writing sequence
 - Decide on the title
 - Write the abstract
 - Write an outline
 - Then refine it, by adding more details
 - Fill in the details
- Check for typographical errors

Why Are You Writing This Paper?

- Which **one** of the following is a valid reason for writing a paper?
 - It will make you famous
 - It will help you get a job
 - It will help you get into a good graduate program
 - You have performed hard work and need to be rewarded with a paper
 - You have something to share with the research community, which will be useful for others to know



In conclusion, we have clearly shown that one can get a good job by publishing in this conference ... oops. Did I really say that?

Why Are You Writing This Paper? 2

- You have something useful to share
 - Throughout the writing process, keep in mind that your goal is to help the reader by sharing the results of your work
 - Your goal is not to impress the reader about your brilliance or other good qualities
 - Your goal is not to describe all that you have done
 - There are billions of people in the world working very hard
 - The reader does not want to know what every one is doing
 - The reader wants to know that which will help him
 - Everything you write should support the central goal of explaining your useful contribution to the reader

The Writing Sequence

■ Suggested sequence

- Decide on the title
- Write the abstract
 - Clearly identify your main contribution
- Write an outline
 - Include entries for each section
 - Include the main points for each section
 - Check if the outline has a good flow
- Refine the outline
 - Mention the main point for each paragraph
 - Each paragraph should have only one point
 - The sentences in a paragraph should be connected
- Fill in the details

■ Alternate sequence

- Describe your novel contribution and empirical result
- Write other sections
- Write the introduction
- Write the abstract
 - After all, we don't know what our contribution is until we finish the section on empirical results
- Repeat the above steps, refining your paper, until five minutes before the deadline

■ My criticism

- If you cannot first identify your main contribution, why write a paper?
- In the former sequence, the abstract shows you the focus of the paper
 - This guides you throughout the writing process

Check For Typographical Errors

- Proofread the manuscript carefully, but just a few times
 - You will stop noticing errors after you proofread the document a few times
 - Have each co-author proofread the document
- Run a spell check before final submission
 - Do this even if you have performed the spell check several times already, and think that you have not made any errors since your last spell check

Organizing the Content

- A common pattern
 - Title
 - Abstract
 - Introduction
 - Related work
 - Your novel contribution
 - Empirical evaluation of your technique
 - Conclusions and future work
 - Bibliography

Title

- If someone will benefit from reading your paper, then he should want to read your paper after seeing its title
 - Avoid very general or vague titles
 - Example: *'Optimizing Scientific kernels on Emerging Architectures'* is not as useful as *'Optimizing Dense Linear Algebra Kernels on Multicore Processors with Shared Cache'*
 - The title should contain words that people interested in your paper are likely to use in a search

Abstract

- After reading this, the reviewer should know
 - What problem you are solving
 - Why the problem addressed is important
 - What the basic idea behind your work is
 - How it improves on other work
 - Quantify the improvement from your work

Abstract 2

- End the abstract with a sentence clearly identifying the contribution of your work
 - How will people benefit from your work?
- After reading the abstract, the reviewer should be excited about your work
 - He should think, “If they have really accomplished what they have claimed, then I will accept this paper”

Introduction

- Provide background on the problem
 - Explain what the problem is
 - Explain why it is important
 - Summarize other approaches that people have taken to solve this problem, and their limitations
- Summarize your work and describe its significance
 - Provide a high-level view of your approach and summarize how it improves on previous approaches
 - Summarize your theoretical and empirical results

Introduction 2

- Given an outline of the rest of the paper
 - You may omit this, if your introduction follows the same sequence of topics as the rest of the paper
 - In this case, refer to the relevant sections in appropriate places in the introduction
 - Example: <http://www.cs.fsu.edu/~asriniva/papers/icpp06.pdf>
- The beginning of the introduction should catch the attention of the reviewer
 - You should get to your point quickly
 - Example: Don't waste space explaining the importance of multicore processors in a submission to a High Performance Computing conference

Related Work

- Summarize related work by others and by you
 - Give any limitations of other work which you overcome
 - Don't be too negative about others' work – one of the authors may be the reviewer for your paper
 - Briefly mention how your work differs from others'
 - Examples: You may solve a slightly different problem, you may obtain greater performance, your algorithm may be more general
 - If you have related papers, make sure that you clearly identify how this work differs
 - Do this even for your prior work which is not closely related, if its title will make the reviewer think that it is related

Related Work 2

- Cite related work that is well respected or which appears in respected venues
 - Example: Improving on results published in *SIAM Journal on Scientific Computing* carries more weight than improving on results published in the *International Journal of Empirical Plagiarism*

Your Novel Contribution

- Explain your algorithm or software, etc
 - Keep your audience in mind when deciding what to explain and what to assume as known
 - Provide a high level view before providing the details
 - You don't need to reveal your entire span of knowledge; just present what is central to the point that you are trying to make
 - Provide simple examples to illustrate your technique

Your Novel Contribution 2

- Some tips on writing clearly
 - Use mathematical expressions, if a plain English description will not be easy to understand
 - For example, the second statement below is clearer than the first
 - 'Assume that the sum of the number of rows and columns of the first matrix is greater than the corresponding sum for the second matrix.'
 - 'Let r_a and r_b be the number of rows in matrices A and B respectively, and let c_a and c_b be respective number of columns. Assume $r_a+c_a > r_b+c_b$.'
 - You don't need to define something in one sentence
 - Define complex terminology in multiple sentences if necessary

Your Novel Contribution 3

- More tips on writing
 - Use the same terminology throughout the paper
 - Example: In describing a differential equation solver, if you use the term 'time step' in one location, then don't refer to it as an 'iteration' elsewhere
 - Even if you mention in the paper that you will some times refer to a time step as an iteration, it can still confuse the reader
 - Use a paragraph to explain crucial point, even if a sentence will suffice
 - An absent minded reviewer can easily miss a few sentences out of the thousands that he will read
 - Alternatively, write it in bold face or italics

Empirical Evaluation

- Provide convincing evidence that your technique is good
 - Just giving the performance of your technique does not establish this
 - Compare against state of the art implementations
 - Compare against theoretical upper bounds on performance
- Explain any aberrant behavior
 - Example: If the parallel efficiency decreases and then increases with the number of processors, then you need to explain why that happens

Empirical Evaluation 2

- A figure and its caption should have enough information for a reader to understand it without referring to the text
- Use different line styles (solid, dashed, etc) to distinguish different lines in a figure
 - Using different colors is not sufficient if a reader prints it in black and white
- Give details of the experimental environment
 - Mention the CPU, OS version, compiler flags, etc
 - Give details of how timing was performed and resolution of the timer

Conclusions and Future Work

■ Conclusions

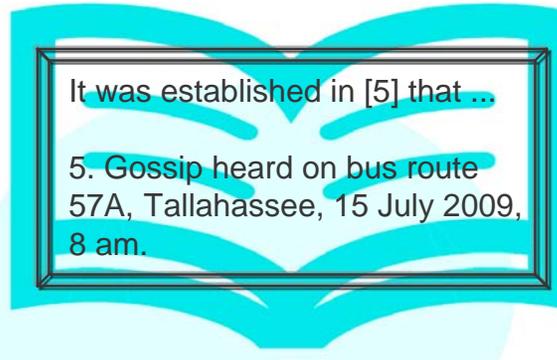
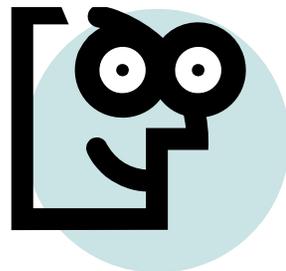
- Summarize important aspects that make more sense once the rest of the paper has been read
 - If something can be understood earlier, then that point can go in the introduction
 - Repeat any important contribution that you would want an absent minded reviewer to remember

■ Future work

- Mention interesting directions to extend this work
- Don't mention too many things, lest the reviewer think that your work is currently incomplete

Bibliography

- Give complete citations so that a reader can locate the cited article
- The bibliography section should also be proofread and be free of typographical errors
- As far as possible, cite journals and respectable conferences
 - It is ok to cite technical reports occasionally
 - Avoid citing web pages and informal venues



Appendix

- You can place material that is not central to the flow of your paper here
 - For example, if proofs will distract from the basic idea of your paper, then you may state theorems in the paper and provide the proofs in the appendix
 - Alternatively, you may write a more detailed technical report and cite it in your manuscript
 - However, an appendix is more likely to be read than the technical report

Life After Rejection

- The good news
 - You are still alive
 - Rejection or acceptance probably does not change your life significantly
- Improve your paper
 - Read the reviews the moment you get them, and express your outrage to your friends
 - Read the reviews again, calmly, the next day
 - Try to address all the criticisms of the reviewers
 - If the reviewers misunderstood you, then it is your fault for not making yourself clear enough
 - Resubmit the improved paper

Useful References

- General writing
 - W. White and E.B. Strunk, Elements of Style
 - URL for original edition: www.bartleby.com/141
- Technical writing
 - SOSP advise
 - <ftp://fast.cs.utah.edu/pub/writing-papers.ps>
 - OOPSLA advise
 - www.sigplan.org/oopsla/oopsla96/how93.html
- Read best papers of good conferences, such as SC and IPDPS