

A Guide to Writing Scientific Papers (Extended Abstract)

This “guide”, as the name implies, is not intended to make students good writers overnight. Many of us are still working at it many decades after graduating. Instead, I hope to give you a glimpse of how the writing process is most effectively tackled, and in so doing give some hints and strategies that you can adapt to fit to your writing style.

Understanding the Writing Process

Why is it necessary to think about the approach to writing you may ask? The reason is because it can both influence the degree of enjoyment or pain experienced by the writer and the quality of the end product.

Many students make the mistake of:

- Skimping on the planning stage (do not do enough)
- Expecting to write the perfect paper in one sitting
- Investing a lot of time writing the perfect sentence, one sentence at a time
- Expecting not to do much cutting or editing of the text
- Viewing the writing process solely as a task of informing the reader (not as part of the research and refining of thinking)

This is a recipe for making writing a stressful and inefficient activity, or one that you will try to put off doing (procrastinate) for as long as possible.

Nobody builds a house by going out and grabbing some nails and wood, and starts hammering, not at least without a detailed plan. Similarly, experienced writers do not expect to produce a finished product in one smooth, uninterrupted sitting. Like the person planning to build a house, there are stages a student typically goes through in writing a scientific paper like an extended abstract.

Typically there are 3 stages for effective writing; a preparation or pre-writing (planning) stage, a first draft stage, and a revision stage. My personal guidelines for the time allocation for each stage are as follows:

Preparation (Pre-writing)	50%
First draft	20%
Revision	30%

Now I will go through each of these stages.

1. Preparation/ Pre-writing

The purpose, content and general structure of the extended abstract is decided during this stage. The more time you spend on this, sorting out and organizing your ideas, the smoother the draft writing stage will go.

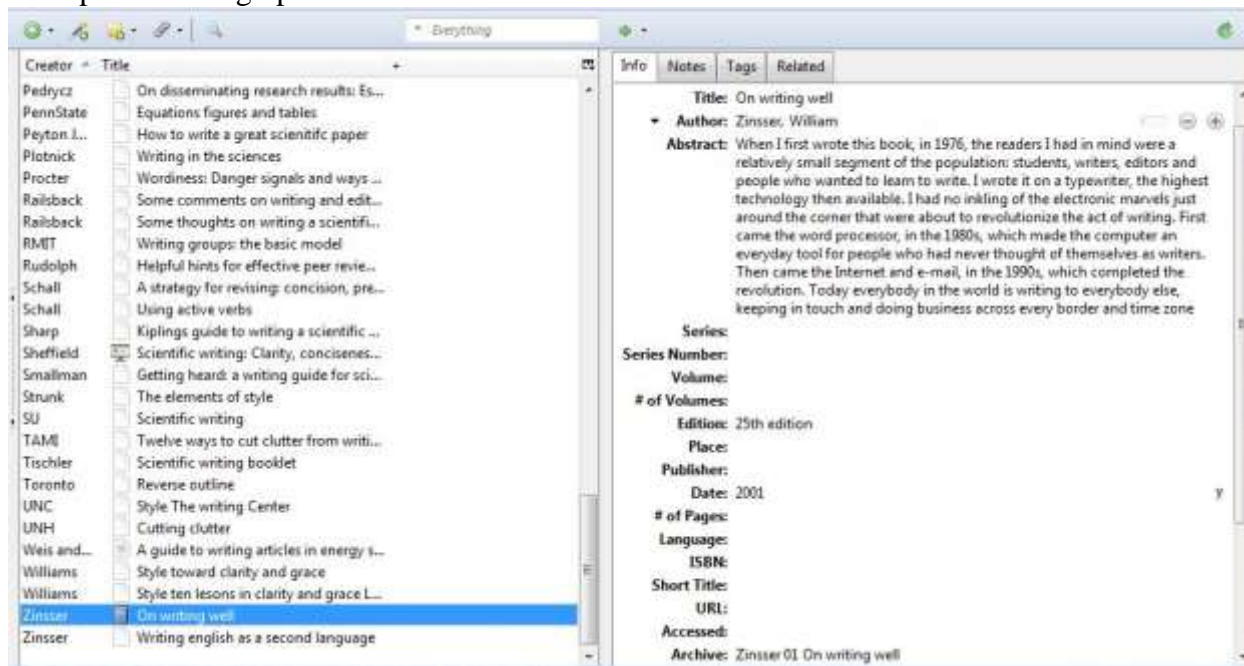
This stage can be further divided into:

1.1 Gather in-depth information

Strategies for gathering this information include:

- Start broadly, work on details later (search strategy: first gain overview and then proceed to more a more detailed search by refining the specific keywords used in the reference search)
- Archive your sources as you go (Use a bibliographic reference database¹: see example below)
- Where possible save sources as pdf or word files with a naming system so you can readily find the material (see example of stored reference sources below).

Example of bibliographic database software

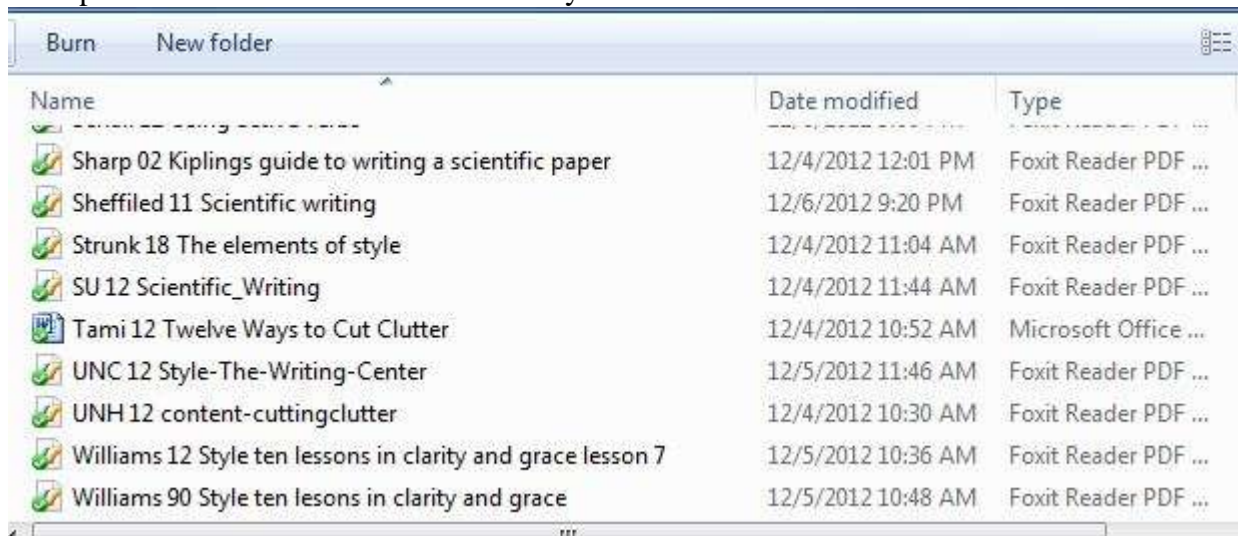


1: Frequently used bibliographic reference databases include Endnote, RefWorks, and Zotero (an open source program).

Also see: http://en.wikipedia.org/wiki/Comparison_of_reference_management_software

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Example of reference sources stored for easy access



Name	Date modified	Type
Sharp 02 Kiplings guide to writing a scientific paper	12/4/2012 12:01 PM	Foxit Reader PDF ...
Sheffiled 11 Scientific writing	12/6/2012 9:20 PM	Foxit Reader PDF ...
Strunk 18 The elements of style	12/4/2012 11:04 AM	Foxit Reader PDF ...
SU 12 Scientific_Writing	12/4/2012 11:44 AM	Foxit Reader PDF ...
Tami 12 Twelve Ways to Cut Clutter	12/4/2012 10:52 AM	Microsoft Office ...
UNC 12 Style-The-Writing-Center	12/5/2012 11:46 AM	Foxit Reader PDF ...
UNH 12 content-cuttingclutter	12/4/2012 10:30 AM	Foxit Reader PDF ...
Williams 12 Style ten lessons in clarity and grace lesson 7	12/5/2012 10:36 AM	Foxit Reader PDF ...
Williams 90 Style ten lesons in clarity and grace	12/5/2012 10:48 AM	Foxit Reader PDF ...

1.2 Evaluate content

As you are gathering and organizing reference sources and information you need to also be considering what perspective or approach you are going to take in the extended abstract. To this end you should be:

- Reading for inspiration.
- To determine what perspective are you going to take?
- What to put in and what to leave out

1.3 Group content

This is the process of assembling information into similar topics or themes.

To do this I open an empty word file and then begin to read through my reference sources and noting any ideas I think may be relevant to the paper in this word document. At this stage there is no order to how the notes are put into the word document.. When doing this be careful to note the source of the idea for later ease of quoting if necessary. Once all the reference sources have been read, I then begin to group ideas within the IMRaD structure (see below). And then I group into similar themes or topics. In this way a rough outline of the ideas to used in the paper is being formed.

1.4 Organize Content/ Establish Framework

Take the grouped topics and turn them into rough paragraphs.
This is fulfilling two functions:

Brainstorming: strategy for generating and exploring ideas, may include mind mapping.

Outlining: it is like a plan, a way of logically organizing the major ideas (hierarchically).

The sciences have a standard written format for manuscripts referred to as IMRaD (see box below). Use this to form the basic structure of the abstract. In the case of an abstract this can be simplified to introduction, body, and conclusion.

Outlining then provides further details to this structure. It is a tentative structure to hang your ideas on.

IMRaD Format

Introduction

This establishes the topic and the purpose of the automation being documented.

- Provide context for robotics application
- Reveal problem with manual procedure
- Show how the automation is intended to solve problem
-

Method

Provides the reader with an understanding of how the robot works and what can be expected in the results and discussion section.

- Describe Mechanism/ Instrumentation

Results & Discussion

Main section of abstract

- Use visual aids where possible (Label all graphs, charts and visuals clearly.)
- Use text to highlight key results
- Explain results and identify conclusions
- Explain significance of conclusions
- Identify potential limitations

2. First Draft

The first draft should be relatively a quick and “easy” stage. The time spent on the drafting process is inversely proportional to time spent on planning and outlining.

Follow your outline

- Write quickly
- Don't try to be perfect. Don't expect a beautiful piece of writing
- Draft = Rough
- Write what you can; skip sections you are having trouble with
- No need to write in order; the order often written in is: Method > Results & Discussion > Introduction > Title.
- Don't try to revise
- Keep the writing simple; no need for complex sentences

3. Revision

3.1 Revise

Analyze abstract at macro (global) level and paragraph level organization. Reverse outlining helps with this.

- Addresses focus or purpose of the abstract
- Structure is logical and supports the purpose of the abstract
- Remove non-essentials

Reverse Outlining

Steps to write reverse outline

1. Identify the main topic of the paragraph
2. Write this in left hand margin
3. How does the paragraph advance the argument?
4. Write this in right hand margin
5. Arrange these topics in an outline
6. Analyse this outline

Levels of revision

Macro: Text structure (‘Big picture’)

- Is the purpose of the writing clearly defined?
- Paragraphs logically organized?
- What is the paragraph trying to achieve?

Middle: Paragraph structure (Function)

- Clear topic sentences?
- Supporting sentences relate to topic?
- Clear linking?

Micro: Sentence Structure (Style/ Grammar)

- Sentences well written/ Easy to understand?
- Style appropriate?

(See appendix for revision sheet and references for guides to revising paragraphs and sentences)

3.2 Editing

Examines each sentence to see if serves the topic of the paragraph and provides a logical flow to the paragraph. (see Williams et. Al. 2010, Zinsser 2001)

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- Each paragraph has one main topic or point, and supporting evidence for this topic
- Remove non-essentials

3.3 Proofreading

Check for grammatical, punctuation and spelling errors

- Read each sentence aloud
- Allow time for several readings
- Take a break, to give a fresh perspective
- Add active verbs
- Ask a friend to read and review
- Use spell/ grammar checker, but don't rely solely on these

Writing is like exercise: the more you practice the better you get!

References

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Perelman L.C., Barrett E., Taradis J. 2001. *Mayfield electronic handbook of technical & scientific writing.* [Internet] <http://www.mhhe.com/mayfieldpub/tsw/toc.htm#1>
(Accessed 11 Dec. 2012)

Williams J.M., Colomb G.G. 2010. *Style: Lessons in clarity and grace* (10th ed.). New York: Longman.

Zinsser W. 2001. *On writing well.* 25th Anniversary Edition. New York: HarperCollins.

Appendix

Reverse Outline Revision Sheet¹

1. Adapted from: Simons D. 2012. Musings on writing.
[Internet] http://www.dansimons.com/resources/Simons_on_writing.pdf (Accessed 6 Nov. 2012)

Preparation

- Print your paper with large margins on both sides
- Create a reverse outline: short topic sentence in left margin; supporting arguments in right margin

Macro Level (Big picture)

- Focus of paper clear from outline
- The structure of argument is clear from the outline
- Each topic in the outline follows a logical order
- Each paragraph topic needed for core argument
- Opening paragraph establishes context & creates interest
- Final paragraph draws conclusion & places results or arguments in context

Paragraph Level

- Each paragraph has only one topic
- Each sentence supports the topic of sentence
- Each sentence follows logically from the one before
- No tangential sentences
- Last sentence is memorable
- Provide topic early in the paragraph

Sentence Level

- Sentences in active voice
- Rewrite weak verbs (is, are was were, etc.) with a more powerful verb
- Cut clutter (reduce wordiness)
- Avoid turning verbs into nouns
- Avoid negatives
- Use punctuation to vary sentence structure & clarify meaning