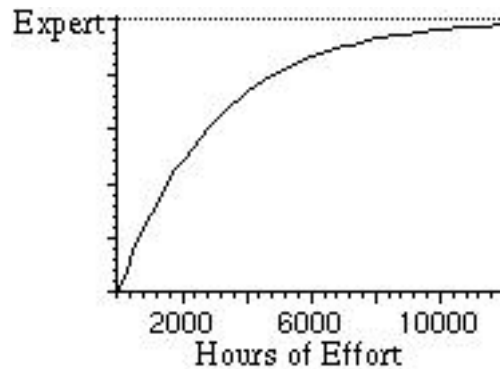


**Expectations:**

It takes about 10,000 hours to become an expert writer (or oral presenter).



In six weeks, you can expect to progress a little along the curve:

- Practice writing
- Practice talking about writing
- Gain confidence in your writing
- Better know where you are headed

**Writing: The Big Picture**

Writing is both a noun and a verb.

As a noun, writing is a product, the written text. It is governed by convention, from grammar rules to cognition rules to reader expectation.

As a verb, writing is a process, the series of activities writers engage in to produce text. And the habits that guide the activities.

The secret to good writing is a combination of both process and product. The author must know the reader's expectations and craft the text accordingly.

**Product: text that makes readers happy**

Beginning, Middle, & End:

Text is linear and finite. These geometrical constraints imply that text has a beginning, a middle, and an end. Readers expect the boundaries to be delineated. Many grammar and style guidelines delineate these boundaries.

this is what happens when the author does not make the boundaries clear

When the boundaries are not clear, the reader can make sense of the text, but only after investing significant effort into recreating these boundaries.

**Unity, Transition, & Development:**

Authors design documents. All the parts must connect. All the parts are focused on a purpose. The whole exceeds the sum of the parts. Without unity, transition and development, a document is merely a laundry list; the reader can only remember 5 things. The design task is akin to fitting a jigsaw puzzle together so the reader sees the big picture. (This paragraph is a disaster because it lacks the very elements it advocates.) *The Science of Scientific Writing* has 7 rules of thumb for such expectations.

**Common Structures:**

(I mention these only because some writing tasks are easier than others.)

Narration: Time is linear; text is linear. Stories are easy, but the moral may be unclear.

Procedure: Easy if the process is linear. Design the linearity into the process?

Grouping: Reductionist thinking. Making sense of the laundry list. More tomorrow.

Definition: Separating out one grouping element and discarding the rest.

Compare/Contrast: Beware of the ping pong match.

Cause/Effect: The story is easy: before => after. Authenticating the mechanism is hard.

**Thesis Proposal and Thesis Structure:**

Table 1: Thesis Proposal Structure

Section	Contents	Comments
Summary	Everything important	The proposal is an odd document because it has no end. Most readers get no further than the summary, so the summary must embody the entire enterprise. Consider avoiding the first person more than usual.
Introduction	Defines a problem. A topic does not suffice.	Present tense (?)
Background	What the reader needs to know to feel confident of your solution. Heavy on literature and/or model development. Sometimes run together with the introduction, especially in shorter proposals.	Consider using the present tense; you may talk about peer reviewed/published results as if they are platonically true over all time, even though the research was in fact conducted in the past. Lots of citations here.
Methods	Your solution. The gold standard is for someone else to repeat the experiment. The utility standard is to have a recipe for yourself and a contract both you and your advisor can live with. The minimum standard is what your advisor will sign.	Officially, probably use the future tense, but the future is klunky in English. Perhaps try the present tense. Avoid the subjunctive mood.
Other Stuff	Time line, deliverables, resumé, budget...	

Most proposals fail because they fail to identify a problem; identifying an area of research or a hunch is not enough.

If your proposal is well written and if your research goes as you expect, your proposal should appear word for word in your report.

Table 1: Thesis Structure

Section	Contents	Comments
Abstract	Theses have abstracts. Abstracts have 4 pieces of information: problem, solution, results, conclusion. If you must, include half a sentence of context information, especially if your audience is varied or your work interdisciplinary.	Often the sentences are long and difficult to parse. Avoid citations in the abstract as many readers will not have access to your bibliography.
Introduction	Defines a problem. A topic does not suffice.	Possible word for word inclusion from proposal
Background	What the reader needs to know to feel confident of your solution. Heavy on literature and/or model development	Possible word for word inclusion from proposal
Methods	Your solution. The gold standard is for someone else to repeat the experiment. While this section is the “story” of your research, consider other structures that are more important to your ideas than the ordering of your research in time. Avoid dwelling on thing you did that did not work.	Officially, probably use the past tense for your work, which is not yet peer reviewed and may not be found true over all time. Possible word for word ± tense changes. Perhaps try the present tense. Avoid overusing multiple verbs tenses to express different eras of your research. <i>“Data had been derived from estimators before the onset of singularities occurred. Then unusual circumstances were being driven by strange attractors while our lunch was delivered. Any conclusions will have been drawn from a hat.”</i>
Results	What happened when you did what you did.	Past tense, like your methods. The results section may be very low on text for folks with quantitative or graphical results.
Discussion	I abhor the word “discuss.” Think “analysis.”	Sometimes the results and discussion sections are combined. Sometimes discussion and conclusion are combined. Sometimes all three are lumped into one section, especially in shorter reports.
Conclusion	The big synthesis.	

I have omitted many parts: cover page, table of contents, lists of stuff, bibliography....

**Process:**

The recipe looks simple:

brainstorm  
outline  
research  
start writing  
edit (\*\*\*think-write-read-think-write-read\*\*\*)  
finish

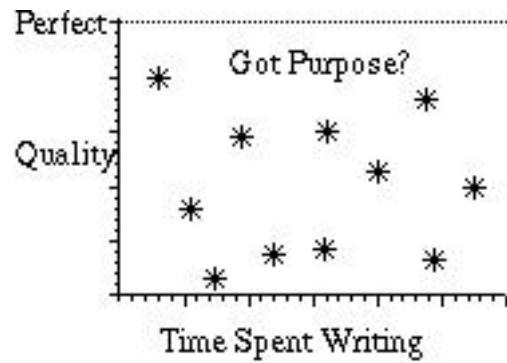
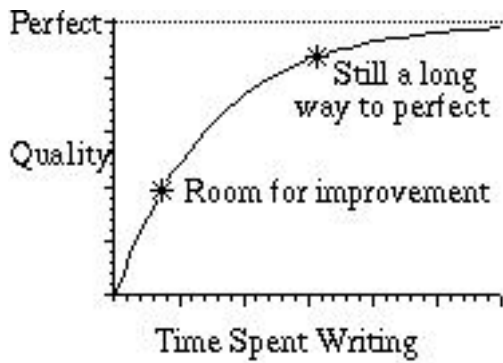
Good writers go through cycles of writing, reading, thinking, and rewriting. The frequency of the cycles and the focus of the rewriting vary from author to author. ESL students cycle at the word level; each word is typed, checked for spelling/agreement, and corrected before moving on. Some authors type entire paragraphs or pages before reading them over. There is no “correct” recipe that works best for everyone. If how you write works for you, continue; if not, try to change your writing habits.

Habits the author can control:

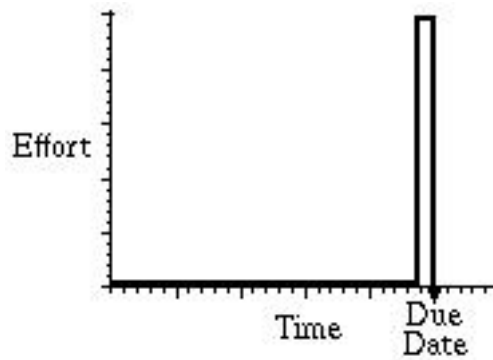
- \* Attention to detail. Pay less attention in early drafts. Proof read in later drafts.
- \* Work on multiple documents simultaneously. When stuck on one, switch to writing the other.
- \* Work on different aspects of a document simultaneously. When stuck on the text, fix a figure instead.
- \* Got writer's block? Force yourself not to use the delete key.
- \* Work at different times of the day.
- \* Learn your own bad habits. Has every English teacher and thesis advisor associated red ink with your pronouns? Then be sure to scrutinize your pronoun usage. Can't spell? Learn to recognize the words you butcher regularly, especially those that the spelling/grammar checker does not recognize.
- \* Start writing the middle of your document. The abstract is difficult to write; your method section is liable to be easier. Description is relatively easy too.
- \* Leave yourself enough time to write well.
- \* Avoid binge writing the evening before the document must be finished.
- \* Stop writing for at least three days. You can do so if you've left yourself enough time.
- \* If you are a perfectionist, suspend disbelief. Documents are never finished, only due.
- \* Decide at the start how perfect a document must be. Recognize this threshold and desist from writing further.

The author's ultimate goal is to cultivate writing habits that make the reader happy. This happy event occurs only when the author recognizes the discrepancy between a draft and what the reader wants.

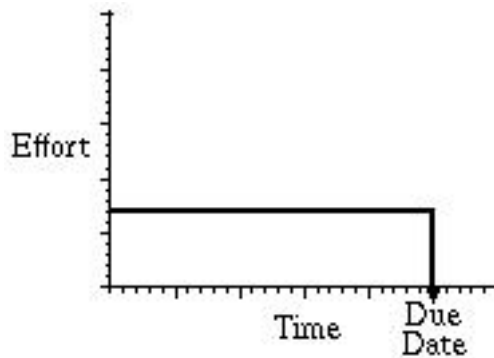
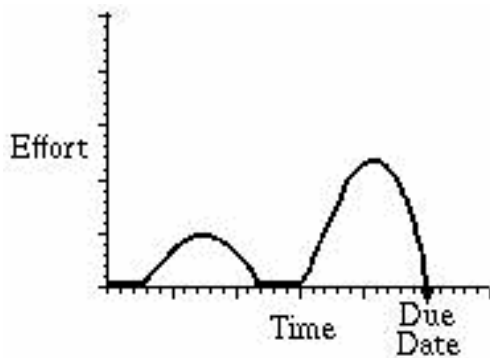
**Some Writing Trajectories for Comparison:**



Monitor your progress and know how good your document must be. If each revision does not get you closer to finished, pinpoint your audience and purpose.



Don't write like an undergraduate.



Two successful strategies. Pick a strategy that fits you best.

## Drafting: Merging Product and Process

Writing is difficult for two reasons:

Text must conform to many constraints.

Text must make sense to both the author and the reader.

Bob hit Bill. He went home.

Pronouns are an example of this mismatch at the word level. The author saw the fight and knows who went home. The example makes complete sense to the author. The reader does not know who went home. The secret to correcting this mismatch and satisfying convention is revision.

Sometimes, writing is difficult due to a lack of familiarity with conventions of grammar, style, and punctuation. If such unfamiliarity is a problem, brush up on your weaknesses. Learn to recognize the rules and their exceptions. When in doubt, pick a convention and stick to it.

The following 2 examples show text in various states of ill repair followed by possible revisions. I claim that the original drafts are excellent drafts. The ideas are sound; the information is there. Trouble is that the information deserves to be better connected for the reader.

### Example 1: A Draft Paragraph Lacking Transition Elements

The internet is a computer network that connects users from all over the world. The internet is also the largest network in the world. There are currently over 20 million users on the internet according a recent survey by Nielson Research. The internet is sometimes called a "network of networks" because it a superset of smaller networks such as America Online or Usenet. It allows users to communicate via email, discussion groups or hypertext. Other services include file transfer, remote login and indexing programs. Originally, these computer utilities were used solely for scientific research. The system architecture was open to promote collaboration and the system was distributed so that in the event of nuclear war it would be usable. Now these utilities are being used to exchange pornography and hate literature. The inventors of the internet never expected the network to be a distribution channel for pornography.

### The Rewrite

With over 20 million users, the internet is the largest computer network in the world. The internet's vast size results from its status as a network of networks, connecting many smaller networks such as America Online and Usenet. As an umbrella network, the internet allows subnet users to communicate via email, discussion groups or hypertext. Other services include file transfer, remote login and indexing programs. The network's size and utility make it ever more attractive to more users.

The popularity of the internet has led to a new set of problems unenvisioned by its inventors. Originally, the internet was used solely for scientific research and defense projects. The architecture was designed to be open to promote collaboration, and the system was distributed so that it could withstand nuclear war. This open, decentralized system has promoted a new degree of free speech: any user can communicate anything to any other user at any time. The unprecedented levels of freedom have resulted in unprecedented levels of the abuse of free speech, such as the exchange of pornography and hate literature.

## Example 2: More Missing Transitions

The SuperSolder process is a printed circuit board solder application process. It is an alternative to Selective Solder Strip application that should provide thicker solder on land pads and has shown better solder joint reliability. Many assembly houses have already implemented SuperSolder into their processes. The industry is tending toward SuperSolder because it offers many benefits over Selective Solder Strip. Intel, however, must test SuperSolder's reliability and manufacturability in its assembly line before beginning production scale use of this potentially beneficial process.

### The Rewrite

The SuperSolder printed circuit board solder application process is an alternative to Selective Solder Strip. SuperSolder's advantages include: thicker solder on land pads, the elimination of expensive photolithography steps, and better solder joint reliability. Because the SuperSolder offers many benefits over Selective Solder Strip, the industry is tending toward SuperSolder; many assembly houses have already implemented SuperSolder into their processes. Before SuperSolder can be incorporated into Intel's own production scale assembly line, the reliability and manufacturability of the new process must be demonstrated inhouse.

### Graphics Guidelines:

1. A picture is worth a thousand words; the higher the information density, the better. As a corollary, a picture that is worth fewer than a thousand words should be removed from a document.
2. As with text, structure will be vital if large amounts of information are to be conveyed. Expository issues of purpose, context, beginning/middle/end, and design apply to graphics. Often the graphic's structure is predetermined and well known by both the reader and the author. When the structure is new, extra care must be taken to convey order the reader.
3. Graphics must convey information visually; the reader must be able to "see" something when looking at the figure. While the expository issues are similar, the principles of graphic design can be very different, and the tools and methods used to achieve visual impact are often quite different from those used to produce textual impact. For an in depth coverage of graphic design principles relevant to technical writing, I can recommend Edward Tufte's *The Visual Display of Quantitative Information* and *Envisioning Information*.
4. The graphic must be referenced in the text. "See Figure 1" is not sufficient. Additionally, the reader must be told what to "see" when looking at the graphic, and how the figure relates to the text.
5. The use of graphics provides a second representation of the ideas found in the text. Such multiple representation has two benefits. First, because readers preferentially absorb information from some media, a variety of representations -- pictures, graphs, tables, and text -- gives the reader a better chance of immediately grasping the author's idea. Secondly, these multiple representations provide a more complete picture of a complicated idea. If the reader can approach the same idea from different vantages, the big picture is more easily grasped. The understanding of a complicated idea is complete when the reader can comfortably switch between different the idea's representations. (See the work of Judah Schwartz for more information on the relationship between multiple representations and learning complex ideas.)
6. Like text, graphics are edited; they go through drafts, through write-read-think-edit-write cycles.