ARMY RESEARCH LABORATORY

A GUIDE FOR TECHNICAL AUTHORS

Creating Texts That Are Clear and Effective

by Paul J. Tanenbaum

ARL-SR-0198 **June 2010**

NOTICES

Disclaimers

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

Citation of manufacturer's or trade names does not constitute an official endorsement or approval of the use thereof.

Destroy this report when it is no longer needed. Do not return it to the originator.

Army Research Laboratory
Aberdeen Proving Ground, MD 21005-5068

ARL-SR-0198 **June 2010**

A GUIDE FOR TECHNICAL AUTHORS

Creating Texts That Are Clear and Effective

Paul J. Tanenbaum
Survivability/Lethality Analysis Directorate, ARL

REPORT DOCUMENTATION PAGE	*Form Approved OMB No. 0704-0188*

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED (From - To)
June 2010	Final	

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
A Guide for Technical Authors: Creating Texts That Are Clear and Effective	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)	5d. PROJECT NUMBER
Paul J. Tanenbaum	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
U.S. Army Research Laboratory RDRL-SL Aberdeen Proving Ground, MD 21005-5068	ARL-SR-0198

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Our organization's primary product is information, and we can deliver that product with much greater effect if we write with skill and with care. This is not about where to place commas, but instead about fundamental considerations such as what information to present and how to organize and express it. In this guide, I present 14 principles to help authors resolve such matters and produce documents that are simple, clear, and convincing. My aim is to maximize both the value our readers derive from our product and the success we achieve in meeting our purposes.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Paul J. Tanenbaum
Unclassified	Unclassified	Unclassified	UU	50	19b. TELEPHONE NUMBER (*Include area code*) (410) 278-6321

Standard Form 298 (Rev. 8/98)
Prescribed by ANSI Std. Z39.18

Table of Contents

Introduction	1
1. Consider Your Audience!	3
2. Follow Directions	5
3. Think Through Five Questions	7
4. Try Factoring Into Questions	11
5. Adhere to the Known-New Contract	16
6. Favor Presenting Deductively	20
7. Beware Noun-Noun Modification	23
8. Use Nominalizations Sparingly	25
9. Watch Ambiguity Surrounding -*ing* Words	28
10. Mind Your Hyphens and Their Brethren	30
11. Don't Capitalize Before Abbreviating Unless…	33
12. Watch Your Spelling and Word Choice	34
13. Don't Underline More Than Once a Year	37
14. Generate Email That's Worth Reading	38
Annotated Bibliography	40

INTENTIONALLY LEFT BLANK.

Introduction

Writing matters. My goal in this document is to help writers think about how it matters and how to do it more effectively. And being an effective writer begins with understanding one's purposes.

We in ARL, even those of us who create technology, are ultimately in business to provide useful information. To produce our primary products—things like actual widgets, data from field or lab experiments, results from computer models, input to test plans, and guidance for designers—requires substantial technical skills. Our expertise typically reflects years of schooling and often decades of experience in the business. But the story doesn't end with our products' creation. As an analogy, even if we farmed the most delicious and succulent lettuce anywhere, neglecting our trucks' refrigeration and letting our crop reach market a wilted, sorry mess would cause all of our agricultural efforts and expertise to come to naught.

Thus, like any enterprise, we must bear in mind our products' entire life cycle. For a major defense contractor, such a life-cycle perspective would cover not just R&D, engineering, and manufacturing (the functions that are roughly analogous for us to the creating of our products), but also marketing, sales, supply, and distribution. Well, marketing and sales in any line of work are ultimately about effective communication. Furthermore, our primary products all take the form of information, so for us supply and distribution, too, boil down to communicating.

Sometimes your goal in communicating is to inform, as in a technical report or when you brief the results of an assessment to a customer. Other times your goal is to persuade, as when you try to get a reluctant PM office to modify their system's design or when you try to convince management of the desirability of adopting some policy—or even of the wisdom of promoting you! In any event, whether you are engaged in informing or persuading, much of your professional effectiveness, and thus your career success, depends on your ability to communicate.

WHAT MY PURPOSE IS—AND ISN'T

To those who may object, "But I'm an engineer. I don't want to write!" I say you sound like the farmer who dislikes maintaining his truck's refrigeration. For those others who lament, "But I'm a scientist. I never really learned *how* to write!" I have better news. You don't need to be Ernest Hemingway, let alone Jane Austen. Although grace and artistry in writing are certainly to be treasured, all that we really need in professional writing is the ability to express ourselves in a fashion that is plain, clear, and well organized. And you can make great strides toward that goal by learning and practicing a fairly small set of straightforward principles. The few guidelines laid out in the following pages, while far from a comprehensive guide to writing in English, should help anyone set down their thoughts in a simple, clear way that most readers will find effective. Readers who would like further information are encouraged to consult the annotated bibliography for many helpful resources.

How to Use This Guide

The guidelines are presented in a top-down sequence beginning with issues that Dungey and Lillywhite[1] refer to as higher-order concerns (HOCs): those that arise at the scale of entire documents. The guidelines then proceed to progressively lower-order concerns (LOCs) that apply within paragraphs, within sentences, and ultimately at the level of individual words. Some of the guidelines are crucial, others less so. The most important are indicated by a star, ★.

Different readers will need and desire different things from this kind of guide. So in trying to make it as useful as possible, I express each guideline at two levels of detail. For a hip-pocket list of quick tips for writing effective documents—and getting them successfully through your management—you can combine each section's title with the section-ending summary, which is labeled "bottom line." For discussion of what the guidelines mean and for demonstrations of how to apply them, I have tried with the body of each section to lay out my thinking and a few examples. Readers who, for instance, find some of the examples duplicative need not linger over every word, but should feel free to graze more lightly.

Like any guidelines, the ones I offer here are much more in the nature of advice than of law: there is always an exception, and there is seldom a unique *right* answer. Writing well cannot be reduced to following a formula, so applying the guidelines calls for judgment. Furthermore, some of these guidelines reflect a component of taste and personal preference.

On the other hand, neither is style in writing by any means entirely a matter of individual taste and opinion. Good writing is marked by adherence to objective standards of clarity and helpful conventions. Take heart, though—such standards need not be borne like a straitjacket. Remember that there is almost always room for an author's style and individual voice to ring.

Bottom Line

Use this guide in ways that are useful to you.
If there are things in it
that don't strike you as helpful,
set them aside—you can always come back to them.

[1] Kevin Dungey and Harvey Lillywhite of Quality Communications Group have taught various courses for SLAD in technical writing, reviewing, and presentation.

★★1. Consider Your Audience!

If there is one principle above all the rest in writing, it must be this one, and all the other principles laid out here derive from it. Whenever we make the effort to express ourselves by the written word, we do so to cause some result in our readers. Whether we aim to entertain, enthrall, dissuade, or incite, whether to surprise or even to lull, we always have some purpose. And if that purpose weren't significant to us we'd not bother writing to begin with, so whatever the nature of our desired effect, achieving it matters to us. For that reason it's important to adapt our methods to our ends.

Fine, we must take our readers into consideration. Let's think about what that might mean. When planning a procedure, no surgeons select between tonsillectomy and knee replacement based on habit or taste, but according to their patients' needs. Nor can even IBM count on success if they're marketing the same product mix in Baltimore, Brussels, and Beijing. We in SLAD, for instance, understand that a customer from the intelligence school at Fort Huachuca will likely need a very different analytical product than a customer from the artillery school at Fort Sill. In all of those examples, it's second nature for the providers to go to great lengths to understand the recipients' needs and desires, the environment they contend with, and how they will likely use what the providers give them. And yet, writers so often fail to think for even a moment about just whom they're addressing. Some even get belligerent: "If they want this information so badly, let them figure out what I mean!" Authors are certainly free to be indifferent or obstinate, but then they shouldn't be surprised if their desired effects never materialize.

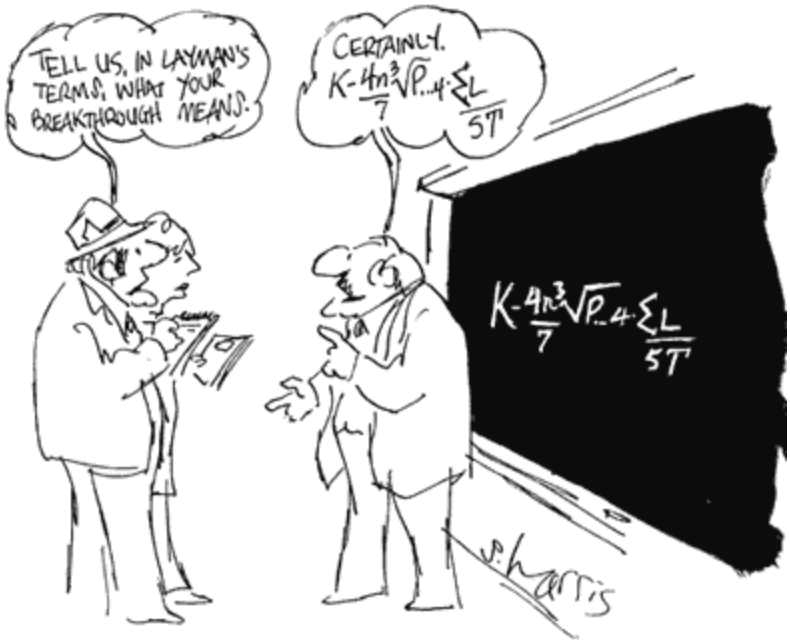

FIGURE 1.—Lighting thy candle and putting it under a bushel giveth light unto no one.

THE PARABLE OF HGTV

Another way to see what's going on is to take a lesson from those sell-your-house programs on the home decorating channels. In a neighborhood of million-dollar properties, one of them won't move. When the cameras get inside, we discover that the place is chockablock with clutter or utterly saturated in what the sellers call "bohemian chic." So the show's team does a fairly simple makeover. First, they remove some furniture—and that moose head over the mantle—to open the place up. Next, they paint over the burgundy of the dining room and the cobalt in the hallway to make all the colors flow from room to room cohesively. Finally, for the big stucco fireplace, they cover it with a piece of marble and some wood trim to bring the look in line with what buyers expect in such a neighborhood. And the total bill is a measly two thousand bucks.

Now they bring back a few buyers who had seen the place before the makeover. Their verdict? "The place looks terrific! It seems so much bigger. And the living room is so nice with the marble fireplace and no moose head. What a great house!" We can chuckle that these buyers could have made those very changes after the sale, but there would never have been a sale. The buyers weren't seeing the value that was latent there, and the sellers had failed to switch from thinking about their home to thinking about their house, a commodity in which buyers' interest required arousing. It is the same with your ideas: for as long as your goal is to live among them in comfort, by all means treat them as you will; but as soon as your goal becomes that they be acquired by someone else, you must make their latent value apparent or you may never close the deal.

WHAT TO DO

If you truly hope for your writing to be effective, you ought to meet your readers more than halfway. You should learn—or at least contemplate—what is important to them. Try looking at the world from their perspective in hopes of anticipating their needs and desires, what they know and what they don't. Remember not to hold forth on things that you want to write about, but try to discuss things that they'll wish or need to read about. Express yourself not merely in the way that comes automatically to you, but in a manner suitable to *them*. Above all, strive to reduce as much as possible the effort required of them to read your writing. By tuning your writing to your readers in this way, you are much more likely to accomplish the very aims that set you to writing in the first place.

Bottom Line

For communication by writing to work,
it must succeed for the readers.
To make your writing work,
first invest in understanding your readers
and then aim your writing at them.

2. Follow Directions

Here's a first application of our prime directive, the advice in section 1 to "consider your audience." Yes, it's sometimes hard to figure out what readers need or want from you. But much of what we write has both its content and its structure tightly imposed by the forms and other paperwork that are so common to our work life, and these templates we fill out give just such insight into the readers' world offered up on a plate. And yet how often respondents discard it! What usually causes this is their focusing so much on themselves, on their own goals and needs and deadlines, that they blind themselves to the obvious and ignore plain requests.

If you were a college admissions officer or a hiring supervisor who had to select from among dozens of candidates for an award or had to decide whether to waive some requirement that you thought important, you would doubtless base your decision on some criteria. And if you had asked the applicants to address those criteria, you might well be unhappy to discover that they had failed to provide the information you had needed and requested. If you were a lawyer in a courtroom, you might even move to strike such a witness's reply as *unresponsive*. And yet we regularly do shoot ourselves in the foot by being unresponsive, by providing other than what is called for.

WHAT UNRESPONSIVENESS LOOKS LIKE

In a request for foreign travel, when asked how the trip would benefit the Army, one person replies that it will allow him to share his latest results with his hosts (No, that's what's in it *for the other guy*). In a request for long-term training, when asked what contributions he would bring to the program, a respondent replies that he will increase his knowledge and his utility to the organization, and when asked how he would use the new skills and knowledge back on the job he replies that the field is changing very rapidly. In requesting permission to work from home, when asked the adverse consequences of being denied, another writer replies that her doctor has certified her as suffering a serious medical condition. Each of these replies does bear some logical relationship to the question it purports to address, but none can be said to come near answering that question.

THE CAUSES

Is it ever good to fail to notice and follow instructions? Whatever the benefit the respondent seeks, readers may well decide instead to grant it to applicants who did observe the rules. Even with no competition at all, the decision may still go against someone who fails to provide information that was essential. And even if they do acquire the sought-after benefit, they may in the process irritate readers or otherwise tarnish their own reputation through such seemingly callous neglect of what the readers feel is a reasonable request. If the readers hadn't wanted to know, why would they have bothered to ask?

WHAT TO DO

Happily, this pitfall is easily avoided. The first step is to—dare I say it?—actually read the instructions and consciously heed what they request. Then once you have done your draft, reread those instructions in light of what thinking you did to formulate the

reply. Would a third party reading your reply without seeing the instructions be able to infer them from what you wrote?

What I'm urging is that you answer the question asked. This is distinct from providing the particular reply that some party might hope for. Because we are purveyors of truth, our jobs sometimes require us to answer "Night," no matter how senior our audience and how devoutly they may wish us to murmur "Day."

EXCEPTIONS?

To be sure, in some situations answering exactly the question asked is not mandatory. Among them are interactions with the media, for which it is appropriate to be prepared with key points you want to make and to guide the discussion in those directions. But that is an openly understood part of the relationship between journalists and their sources. And even there you cannot utterly disregard the questions without appearing to your eventual audience as disdainful or deceptive. Then there is the occasional situation where you are fully aware of what your readers expect and yet you choose consciously to reply otherwise, perhaps evading a topic altogether. This calls for great prudence.

Bottom Line

Where instructions or questions are posed explicitly,
pay attention to the expectations
and satisfy them
unless there's a really good reason not to.

★3. Think Through Five Questions

Having considered your audience enough to form a sense of what they should be told, you must next determine how to go about telling it. Instead of just diving in with the first line of page one, it's a much better idea to give some explicit thought to the top-level shape of your message and how, overall, your argument should flow. This will also help you find any gaps in your argument and to recognize all the irrelevant matter that needs to be cut.

One high-level template that is quite effective in many general-purpose applications comes from the advice that Dungey and Lillywhite offer on constructing an abstract. Although a good abstract—as the name suggests—distills an entire document down to a few crisp sentences that convey the key essentials, what works well in miniature serves just as usefully in sequencing entire documents. Despite their different scales, the two products benefit equally from careful selection of those same bare essentials.

FIVE QUESTIONS

We can think of Dungey and Lillywhite's template as a five-question form. It looks like this:

1. **Issue**. What major goings-on in the larger world motivated you, the author, to undertake the endeavor you've now set out to write about? Perhaps there's some bigger problem that your contributions get us closer to solving, or an opportunity in the environment that your efforts could gainfully exploit.
2. **Objective**. What one or two questions did you set out to answer whose resolution would move us appreciably down the road to tackling that issue?
3. **Results**. What, specifically, did you accomplish in the way of answering the questions inherent in the objective?
4. **Conclusions**. What have you inferred from the results?
5. **Recommendations**. What are appropriate next steps or your proposed way ahead? What future actions do your conclusions suggest could get us even further toward resolving the issue?

HOW TO ANSWER THEM RIGHT

We begin at the level of issue. You should strive for a formulation of one that best frames your message. That statement of the issue is your best chance to grab your readers' attention. A juicy issue is what convinces them they should care enough to carry on reading. Also key is that it should accurately describe the overall topic that your readers are in for: if they think they sense a bait and switch, you'll lose them in a flash.

Like your issue, your objective merits careful planning: an investment of thought here pays off, and often for you even more than for your readers. Until you've tried it you might not believe how much newfound clarity this rumination can provide you. Without such clarity you are susceptible to vague objective statements amounting to "do good stuff" that can infect entire documents with their squishiness. A good technique that exposes to daylight any squish is to resist casting objectives as actions like "test this" or "demonstrate that," sticking instead with question form. And one indicator that you've found a crisp objective is having limited yourself to yes-or-no questions.

The results portion typically constitutes the bulk of any but the briefest documents, and this meat of the story is where technical authors usually feel most at home. That's OK, so long as you don't cram into this portion a lot of material that doesn't pertain to either the objective you just crafted or the larger issue. One thing that often does belong in this portion of a document is any discussion of the novel or important means by which you accomplished the results.

What counts as conclusions? Whatever the results have taught us. So notice that *conclusion* here does not mean "ending" (of the document), but rather "logical deduction." And, in general, your audience will be far less interested in lessons *about* the results than in lessons *from* the results: what do we now know that we couldn't have known until the results were achieved? Besides, that first kind of lesson, the ones *about* the results—for instance "the methodology presented here is highly effective"—can make you appear to readers as self-congratulatory. If you can't find any lessons *from* the results, then you've likely come nowhere near meeting your objective, and you probably should include that fact as one more result.

When it comes to recommendations, the kiss-of-death variety is "more of the same" or any proposal that begins with the word *continue*. For one thing, they can make you appear to readers as self-satisfied or lazy. The good news is that even when this "keep on keepin' on" tone is their first-draft approach, authors almost always have behind it much stronger ideas. Surely you don't wish to shoehorn the future into the fossil footprint of the past; what twist would be advisable, what clever extension or novel application?

Recommendations come in three flavors, according to who you think should be carrying the weight. Perhaps most important are the second-person recommendations ("You, the readers, ought to…"). By this point in a carefully constructed document, you'll likely have earned the readers' trust, so they may well heed your counsel. As to first-person recommendations ("I should…"), most turn out to be indirect expressions of what are really second-person material ("You should concur in my going off to…"), and most of the rest aren't so much recommendations as gussied up conclusions ("Based on these results—and just so you know—I'm going to..."). Third-person recommendations ("Some other Joe ought to…") are often the least useful. Unless they are second-person in disguise ("Please make Joe…"), there's not much your readers can do about them beyond nodding in sympathetic impotence.

THE TEMPLATE IN ACTION

Although no single template is suited to every conceivable document, you might be surprised at the variety of document types for which the five-question template or some minor variant serves admirably. Our first example is the weekly activity reports, which are paragraph-long summaries of key events for the commanding general of RDECOM, who forwards the most important ones to the CG of AMC. Here's one submission:

> *ATEC personnel met with ARL staff to discuss possible collaboration in support of the MT-143. The meeting confirmed to ATEC personnel that ARL's test capabilities more than meet their requirements. This meeting was a significant step in keeping all parties current on subsystem survivability analysis model input specification programs.*

Note, please, this version's choice of overall topic: "we held a meeting." For impressing readers, this revelation ranks with describing software development as the practice of sitting in a chair and looking at a monitor while pushing lots of the buttons on a keyboard. But this isn't just any reader, he's a two-star general—the boss's boss's boss's boss's boss. What opinion would he form of this author's judgment?

OK, so the initial choice of topic was inappropriate; can the five-question template help us do better? A few moments' careful consideration of details the author hadn't originally thought to include might result in five answers sketched like this:

1. Issue: OSD has been pressing the services to perform developmental testing more efficiently.
2. Objective: We had a hunch that our new set-up was particularly well suited to ATEC's upcoming task of assessing the MT-143.
3. Results: We laid it out for them, and it turns out that it not only solves the MT-143 issue, but they can also apply it much more broadly.
4. Conclusions: Their broader uses of our set-up are likely to provide us high-quality data to support our model development.
5. Recommendation: We ought to try leveraging their data in our validation.

At this point, a far more powerful weekly activity report practically writes itself:

> *Stimulated by an OSD drive for efficiency in developmental testing, ARL has briefed ATEC evaluators on new laboratory capabilities that should speed the evaluation of the MT-143's robustness against key operational threats in OEF. Besides eagerly accepting the offer, ATEC proposed exploiting these unique ARL capabilities for many more programs. The data from these further uses should help ARL validate models now under development, which will reduce the need for their own testing and thus conform all the better with the OSD initiative.*

Although it comes at the cost of increased length, this version of the selfsame story is packed with information, and only the kind of information that anyone, particularly a senior leader, would find interesting. The first of its three sentences lays out both the issue and the objective, thereby taking care of all the setup. The middle sentence gets to the guts of what took place. And the final sentence, merging useful conclusions with a compelling way ahead *and* referring back to the issue, thus cinches the little package in a nice bow.

A promotion (or CASE) package is another type of document where you could use a variant of the template to fully describe one of your accomplishments. This variant would probably not include explicit recommendations, since they had better amount to "promote me!"

1. Issue: A major problem for coalition forces in the mountains of Afghanistan is fatigue, even exhaustion.
2. Objective: Could I eliminate disturbances of the nighttime peace by integrating current sniper-detection technology with kinetic mechanisms?

3. Results: I linked a PuAs IR sensor to three standard munitions and demonstrated ability to engage targets without operator intervention. I've since established a collaboration with SEDD to further mature 3-III semiconductor technologies that wouldn't create Superfund sites.
4. Conclusions: I assessed that, though effective at suppressing hostiles, use of 500-pound bombs tends to waken even the soundest-sleeping friendlies.

Just as with the weekly activity report, this skeleton—minus the question tags, of course—lends itself to direct conversion into a final text that tells a taut story.

In summary, this five-question template is a valuable resource. Even in those situations where it seems a poor choice of architecture for your document, it has further value because, no matter what organizational skeleton your document fleshes out, a few minutes' focused thought about the five questions improves your odds of including the apt, all the apt, and nothing but the apt.

Bottom Line

It's really helpful right up front to puzzle out these five matters:
Why care?
What was attempted?
What came of it?
What to make of it?
Where to go with it?

★4. Try Factoring Into Questions

Many things can contribute to rendering a piece of writing difficult to understand. Sometimes topics demand highly technical vocabulary that is familiar to only a narrow community. Occasionally the subject matter itself is inherently complex, so the ideas and reasoning are hard to convey clearly. But even in the face of a difficult subject and arcane jargon, there is much that authors can and should do to minimize the effort they require their readers to invest. A consideration that can be key to helping the readers is the sequence in which one presents ideas, and there is a straightforward technique, more general than the five-question template of section 3, for assessing the sequence of ideas in a draft and culling, adding, and rearranging them to improve it.

A Brief Example That Needs Improving

As you read the passage below, notice how you react to the sequencing of ideas and ask yourself if your reactions don't feel familiar. You may find it tough sledding, but do labor through the reading: it pays off by permitting us to compare the passage to a much clearer version. (To facilitate that comparison, I prefix each sentence with a superscripted number.)

> [1]*Binary search is a simple approach that performs efficiently.* [2]*Its fundamental step is to compare an item being sought to the middle element in the data set.* [3]*The job of searching for a particular element in an ordered data set is a basic operation throughout computer science.* [4]*Even enormous data sets are tackled quickly by binary search, which takes advantage of the power of exponential growth.* [5]*Binary search is fast, but we can say more: in a very real sense no possible approach could be faster.* [6]*Still, that optimality of binary search is a theoretical result.* [7]*This means, for one thing, that for some particular searches other approaches can be faster.*
>
> [I told you this would be a grind. But hang in there…]
>
> [8]*At each iteration, binary search effectively shrinks our problem by half, so it just iterates by attacking the ever-shrinking subproblems with the same logic.* [9]*And because each such iteration eliminates half of the remaining data set from consideration, binary search can process a data set of 2^k elements in k iterations: one could search through 300 million Americans' social security numbers without having to look explicitly at more than $\log_2(300{,}000{,}000)$ elements, which is a mere 28 people.* [10]*The way the repeated halving occurs is that whenever the middle element doesn't match the item sought, that comparison will have found that one of the two halves of the data set can't possibly contain the desired item—either the elements in the first half are all earlier in order than the desired item, or those in the second half are all later.*

> [11]*Binary search retains a pivotal role in information processing even though the theoretical analysis simplifies away certain complications that can be taken into account to speed up more sophisticated sorting approaches.* [12]*One such assumption is that each comparison takes a constant time.* [13]*In practice, before a data element can be compared, it must first be fetched from memory, and when the data set is large, some fetches can take longer than others and nearly every fetch takes much longer than a comparison.*

Yes, the passage mentions logarithms and exponentiation, and you may feel a bit rusty about that stuff, but I'll bet that a bigger source of difficulty with this example is that the author seems to have spilled a bucket of ideas onto the page and left them for you in a tangled heap. Each new sentence adds to the mayhem and, what makes matters worse, it feels as though ideas appear, submerge, and then resurface in a haphazard way. This requires you to keep track of far too many ideas at once, or else stop at every turn and resurrect ideas that had been crowded right out of your attention.

FACTORING INTO QUESTIONS

So how to address this problem in an organized way (while bounding your own effort according to that essential maxim: the easier, the better)? I recommend a technique that Dungey and Lillywhite teach, one that they call question factoring. This technique is an example of the general fact that it's easier to see the structure of a thing if you first boil off some of its details. I do that here by proceeding through the problem text one sentence at a time, creating a list in which each entry can be thought of as the question that is answered by the corresponding sentence in the text.

How does the passage about binary search factor into questions? Well, its thirteen sentences seem to get at matters like this:

1. Is binary search a good way to search?
2. What is the fundamental action in binary search?
3. Why is search important?
4. How is binary search special?
5. Does it compare well in speed to other approaches?
6. Is there another side to the story?
7. What sort of practical caveat applies?
8. How does binary search break a problem down?
9. How long does binary search take?
10. How does breaking the problem down work?
11. How do the limitations of this analysis affect the conclusion?
12. And what sort of assumption limits the analysis?
13. What's wrong with assuming constant time for comparisons?

Seen at this level of abstraction, the idea sequence can clearly be improved.

Finding a Better Sequence

Having the text factored down to questions makes it easier to assess the sequencing of your ideas, and then, too, to reorder those ideas into a more apt sequence than if you were dragging around the entire sentences in their fully detailed complexity. For the sample passage, for instance, it will feel more natural to the readers if we answer question 3 (about what makes search important) before any of the others, thus introducing and perhaps motivating the subject of the entire passage before delving into a discussion of a particular technique. Similarly, note that the speed of binary search is discussed in both of sentences 5 and 9, so this discussion is interrupted by no fewer than three intervening sentences. We should probably collect that discussion into a single contiguous stretch. A bit of shuffling yields this sequence:

1. Why is search important?
2. Is binary search a good way to search?
3. How is it special?
4. What is the fundamental action in binary search?
5. When the comparison doesn't match, what key observation holds?
6. How does that serve to break the problem down?
7. How long does binary search take?
8. Does it compare well in speed to other approaches?
9. Is there another side to the story?
10. What sort of practical caveat applies?
11. And what sort of assumption limits this analysis?
12. What's wrong with assuming constant time for comparisons?
13. How do the limitations of the analysis affect the conclusion?

Note that resequencing the questions this way also shows a better focus for—and thus a rewording of—what are now questions 5 and 6.

Try thinking of a list of questions that's factored out of a passage as if it were the outline for a journalist's interview. Does our modified sequence of questions seem a coherent structure for such a journalistic event, considering that some of the questions should be imagined to have arisen out of the course of the interview itself as it unfolded in real time? If so, then our improved passage will feel to the readers like a conversation: not only will the order of our topics be fathomable to them, but the very topics addressed will feel to them to be the ones that they themselves would ask about if they were having the conversation.

Restoring the Flesh onto the Bones

Having resequenced the questions, we now round third base for home. The final step in the question-factoring technique is to return to the realm of the passage itself by again expressing our thoughts, but this time as the sequential answers to the better list of questions. See if you don't find the revised passage below less work to read through and also more clear:

[1]*The task of sifting through an ordered data set in search of a particular element is a basic operation throughout computer science.* [2]*A simple approach that performs this operation efficiently is binary search.* [3]*It takes advantage of the power of exponential growth, tackling the job quickly for even enormous data sets.*

[4]*Binary search is based on the fundamental step of comparing the item being sought to the middle element in the data set.* [5]*If they don't match, then a key fact comes to the rescue: the comparison will have indicated that one of the two halves of the data set can't possibly contain the desired item—either the elements in the first half are all earlier in order than the desired item, or those in the second half are all later.* [6]*This effectively shrinks our problem by half, and we can just repeatedly apply the same logic to ever-shrinking subproblems.* [7]*Because each such iteration eliminates half of the remaining data set from consideration, binary search can process a data set of 2^k elements in k iterations: one could search through 300 million Americans' social security numbers without having to look explicitly at more than $\log_2(300{,}000{,}000)$ elements, which is a mere 28 people.* [8]*Binary search is fast, but we can say more: in a real sense no possible approach could be faster.*

[9]*Still, that optimality of binary search is a theoretical result.* [10]*This means, for one thing, that for some particular searches, other approaches can be faster.* [11]*Furthermore, our analysis of its running time assumes that each comparison takes a constant time.* [12]*In practice, before a data element can be compared, it must first be fetched from memory, and when the data set is large, some fetches can take longer than others, and nearly every fetch takes much longer than a comparison.* [13]*More sophisticated sorting approaches can be sped up by taking such complications into account, but binary search retains a pivotal role in information processing.*

THE TECHNIQUE SCALES NICELY

Although this example has demonstrated question factoring at the level of individual sentences, much the same approach can help work out the sequencing of thoughts at larger scales. What should the first paragraph discuss, and the second? How should you group and order the entire text into chapters? Paying attention to these points will give your entire documents a tightness and lucidity. It's easiest to understand the technique in that bottom-up way—within sentences, then paragraphs, then chapters, and then the entire piece. But when it's being applied, it has to go top-down. Think of your document like a house: when remodeling, you don't bother fussing with the arrangement of pictures on the walls until you're sure no more walls will be moved.

Paring out Vestigial Information

Question factoring is also useful in an additional way. Besides making it easier to spot whether a single suitable question is being answered at any particular point in the text, it likewise helps find what information is present but unnecessary. It is normal in refining a document to discover clauses, sentences, and entire paragraphs that should be stricken. Often such text actually *becomes* vestigial—the reason it should go is not that it is poorly expressed but that, as the message grows clearer in the author's own mind and on paper, that message actually evolves, and there emerges a parallel clarity concerning what information belongs and what you should delete.

Is This Practical?

Two practical objections to this technique often arise. Some people argue that there are many quite distinct questions that might be answered with a sentence such as

> *Smith and Jones designed a series of experiments to assess the severity of the system's problems with cosite interference.*

Fair enough. The trick here is to consider the sentence in its context and try to get at why the sentence was created at all. Like riding a bicycle, this factoring of a text into questions becomes easier and more natural with practice.

The other objection goes like this: "That looks like a lot of time-consuming work; do you really expect it for every blurb I write?" Luckily, you probably won't need to go through the entire process for very many passages, explicitly writing out a list of questions and puzzling out how best to rearrange them, before you find you've got the hang of it. After that, you'll be comfortable enough looking at a text that way to be able to do a fairly quick skim, get a sense of the order of things, and see straight away if there's a better sequence.

A Word about Outlines

Most of us associate outlines with our third-grade teacher's disappointment when we couldn't keep straight whether it was numerals first or letters, or (Saints preserve us!) committed the cardinal infraction of "having an *A* without a *B*." But it turns out that if Miss Othmar had focused her lessons about outlining less on its rules and more on its purpose, we might have seen that, like question factoring, creating an outline before writing a single word of the document itself can be an effective means of organizing our ideas.

Bottom Line

Readers more easily follow your thinking if you present your ideas in a sequence that feels natural to them. A good way to do that is to think in terms of the succession of questions you are answering.

★5. Adhere to the Known-New Contract

It is no accident that stories have the form they do. They start with some context, then something important happens, and then things get worked out. That structure constitutes a shared way that is quite comfortable for taking in verbal information. And that simple fact provides a valuable pattern for shaping your writing to suit the readers.

It's helpful to understand yourself to be leading your readers *from wherever they are* to where you want them to be. This means that as each idea makes its first appearance in your prose, it should follow—both chronologically and rhetorically—from another idea already in play. As much as possible you should proceed from what the readers already know to what they will find new because, though they might not be aware of it, readers expect you to operate that way. For this reason, the principle is often referred to as *the known-new contract*. You never explicitly negotiated it, but your readers assume you'll abide by it.

WHAT VIOLATIONS LOOK AND FEEL LIKE

So how does all this work in practice? Consider this sentence:

> *Though they are rugged, water vapor-containing environments can cause such components problems.* (1)

Here's a transcript of the kind of mental activity that goes on at some level as a reader processes that passage:

> "'Though they are rugged…' Who is? I *think* I know, but we'll see… Now, water. (What about water?) No, no… water *vapor*. Wait, wait… somebody's ruggedness and water vapor and now containment, too. (Can I keep all those balls in the air? And don't forget that the sentence started with *though*, so I guess at some point we'll encounter a contrasting thought!) Hmmm, now environments. Well, ruggedness does have to do with holding up in various environments, so I guess they're somehow connected. And I can do a little combining: the environments do the containing of the water vapor. But now they're causing something… Well, they're not causing such components. No, the 'such' components are the ones we'd been reading about for several pages, and now I see that they are what's rugged. So what is it that the environments cause for the components? Problems! I guess that's the contrasting thought: problems despite ruggedness. Ah, that's how it all fits."

Isn't that pretty much what it felt like for you? Even if your conscious experience wasn't like that, below your surface exactly this kind of processing must have gone on, and that's an awful lot of work for even the unconscious brain to have to do.

CONFORMING TO THE CONTRACT REALLY HELPS

Now suppose that instead of that version (1) the author had written:

> *Such components are rugged, but they can have problems in damp environments.* (2)

The first thing encountered in this version is *such components*, which obviously links back to an idea that had shown up previously. So in beginning to read (2) you feel that you're still in the same discussion you'd been having up to this point. And even within the sentence, the march of ideas in (2) seems more orderly. Ruggedness relates back naturally to components, and problems seem related to ruggedness. The latter relationship is an inverted one—problems should decrease as ruggedness grows—but the inversion is flagged on the spot by the intervening *but,* and readers aren't left lugging along with them that premonition that they may eventually encounter a contrasting thought.

There are also other senses in which (2) is a known-new improvement. Versions (1) and (2) each say that the components are rugged and that the components can have problems. And in saying the two things, each sentence refers to the components once explicitly and once by the pronoun *they*. But in (2) it's the earlier reference to the components that's the explicit one, so that when *they* shows up there's no question that it refers to something known. And in (2) the two occurrences—*components* and *they*—are very close together, whereas in (1) they are at opposite ends of the sentence. The drawback to putting *they* so much earlier is that as soon as it is encountered in (1) readers start searching out a known for it to refer to. When they then encounter *environments* many assume this new idea to be the known, so they try out environments as the meaning of *they*, only to require persuading further along in (1) to shift that guess away from *environments* and safely onto *components*.

THE CONTRACT HAS FUTURE VALUE, TOO

Of course, leading your readers to where you want them to be can proceed even more smoothly if you plan ahead; this amounts to turning the known-new contract to your advantage. The way you sequence the ideas you discuss is an opportunity not only to link well to what's come before, but also to facilitate what you're about to bring on next. For instance, imagine the contexts in which the discussion of rugged components might appear. If the very next sentence starts out like "*Considering that the jungles of Borneo are an important scenario for planners…*," then the improved version (2) is probably fine. On the other hand, if the next sentence discusses the problems themselves, perhaps like "*Corrosion and adsorption of chemical agents have both been observed*," then it may be better to adjust the ending:

> *Such components are rugged, but dampness can cause them problems.*

Besides allowing us to sharpen *damp environments* to the simpler *dampness*, swapping *problems* to the end allows the very last word of your current sentence to link tightly to the sentence to come.

THE CONTRACT IMPROVES AN ENTIRE PARAGRAPH

Abiding by the known-new contract is often far less subtle (that is, far easier) than that example. Here is a more straightforward example of an entire paragraph that could use improvement:

> *A system you all have been familiar with for decades is R2D3. Allied forces, just like us, benefit greatly from its flexibility. What made interoperating in Desert Storm fairly easy was that our allies switched from the less-capable COTS systems they'd been using before to R2D3. And the new administration has made clear that we will become ever more reliant on coalition warfare.*

Reading that passage, don't you get the feeling you're being bounced around in a bumper car? As in the first version of the passage about binary search in section 4, the ideas seem always to be leading us two steps forward and then one step back. That's a good indicator that the known-new contract is being disregarded.

But take a closer diagnostic look at what ails that paragraph. One symptom is that the beginning of every sentence marks the debut of yet another topic to step onto an already crowded conversational stage: system, Allied forces, interoperating, new administration. Dually, look at what topics bring up the rear of these sentences. In the first and third sentences, it's R2D3, which is the very topic of the entire paragraph! The end of the second sentence is occupied by a topic that's only a bit newer: R2D3's flexibility. And the final sentence's closing topic—coalition warfare—is but a short conceptual step from the now-familiar topic of allied forces.

So let's try to conform better to the contract by merely rearranging the ideas within each sentence:

> *R2D3 is a system you all have been familiar with for decades. Its flexibility has greatly benefited us and allied forces. Because our allies switched to R2D3 from the less-capable COTS systems they'd been using before Desert Storm, interoperating was fairly easy. And coalition warfare will become ever more important: that much has been made clear by the new administration.*

Note for starters that the first sentence's explicit message—what the sentence comes out and states—is that its readers are familiar with R2D3. So here the obvious candidate for the known idea is R2D3, not the abstract concept "systems with which you are familiar." Similarly, in the final sentence the word the author uses to describe the administration is *new*. So why smack the readers in the face with the new idea of a White House transition until after the authors have said all that they are going to say about interoperating with allies? Nor need the rearrangements be limited to flipping a sentence end for end: where the improved version describes the allies' hardware upgrade, it places the new idea of those less-capable COTS systems *after* our old friend R2D3.

When writing seems to flow smoothly, readers get the point at far lower cost. When they don't feel buffeted by turbulence and don't feel the need to clutch something firm to steady themselves, they waste less of their energy keeping themselves oriented so they can invest more of that energy in engaging with and really absorbing the ideas on offer. And at that point they will have been led from where they were to where the author wanted them to be.

Bottom Line

Readers do better if you proceed
from what they find familiar
to what they find novel.
Consider this within and between sentences.
It can also be a good way to sequence
larger units of your writing.

6. Favor Presenting Deductively

As a writer, you need two things from your readers: their trust and their attention. Depending on the circumstances, either of these commodities can be the more scarce or important. In managing readers' trust and attention, you must assess what balance of the commodities is best to aim for. You can then go a long way toward accomplishing that balance by choosing appropriately between a corresponding pair of ways of structuring your text.

The two ways of structuring your ideas are called *inductive* and *deductive* presentation. Each and its benefits can be appreciated if we think in terms of question factoring, as discussed in section 4. If you were engaged in an actual conversation with your readers, what questions would they likely ask? Answering those exact questions—and in the order they would have come up—makes your document very effective for the readers. Here's how it works…

INDUCTIVE PRESENTATION

If your readers are apt to react to your arguments in terms such as "How do you know that?" or "Why should I believe you?" you may want to offer the basis for your conclusions right up front. This is the inductive form. Because it presents the argument that leads up to a result before presenting the result itself, inductive presentation puts the emphasis on your evidence. Here's an example of a technical passage that is structured very inductively:

> *Suspecting that the voltages on the board might be unacceptably high, we confirmed the problem experimentally, and that led to a system-level exploration for RF leakage. The leaks we uncovered will be a problem whenever the system is used within the side and even back lobes of friendly radars. Since the fix we envision is simple, we find that enhancing the design to remove this susceptibility is imperative.*

A prime example of the type of readership for whom inductive presentation may be highly effective is an audience of scientists. A key component of their training and socialization is to subject every claim to rigorous examination. Moreover, this culture of steel-brush treatment is an important guarantor of the integrity of the scientific method. So a process that feels natural to many scientists is to examine data, then consider how it has been applied, and finally assess the conclusions that purportedly follow from that application—a textbook inductive sequence.

More general examples of a good use for inductive presentation are those settings in which you wish your audience to learn not by being told something, but by experiencing the thing. Because doing or discovering on one's own can be more profoundly effective than more passive approaches, you may sometimes choose to introduce all of the building blocks and then allow the readers to live the assembling of your shared intellectual edifice.

DEDUCTIVE PRESENTATION

If, on the other hand, your readers' reactions are more likely to amount to "So what?" or "Why are you telling me this?" then that is the first thing you should resolve for them. You should lead with your overall point and follow with the supporting evidence and details. That is a deductive presentation. It's the generalized form of what the military often calls *BLUF*, for "bottom line up front." To illustrate, here's the same technical passage we just saw, but now presented deductively:

> *We strongly recommend enhancing the system's design to eliminate cosite problems. The required fix is simple, and the operational need is great because the system often operates within the back and even side lobes of friendly radars. Our system-level exploration uncovered significant RF leakage, and we have confirmed that this induces unacceptably high voltages on the board.*

DEDUCTIVE IS USUALLY BETTER

All Americans should be forever grateful that, when he rode through every Middlesex village and farm, Paul Revere did not explain to each whom he met, "I was watching the North Church and I saw that they had hung one light in the belfry, so I concluded that it was time to make the rounds in order to warn people that the British are on the march." We may grant that none who'd heard such an account would have quibbled with the soundness of Revere's argument, but so inductive a packaging would not have served his purpose that night.

In reality, and despite the technical nature of our work, surprisingly little of our writing is science aimed at scientists. Our technical credibility is not typically what is at issue. No, it is much more likely that your readers—even the Ph.D. physicists among them—are unconsciously doing some cost-benefit analysis: is there enough of interest to me in this document to merit my continued interaction with it? That is why presenting your arguments deductively will usually be more successful.

Presenting an argument in a deductive structure also serves to jump start the known-new contract discussed in section 5: because you've announced to your readers their rhetorical destination, they are able to recognize it as known throughout your subsequent elaboration. Of course, an inductive presentation adheres to the known-new nearly automatically, but since the deductive option can do so too, you might as well go deductive to reap the other advantages.

The benefits of deductive presentation accrue even to readers who yearn for the evidence. Having read your overall assertion, such readers are equipped to assess whether they need further convincing, and either read on or skip ahead accordingly.

Some authors find inductive presentation natural because it entails committing things to paper in exactly the same sequence in which they were discovered or performed. That kind of naturalness, though, borders on self-indulgence. Whatever the order in which authors first record their thoughts, they can always go back and shuffle them for easier consumption. As Dungey and Lillywhite say with mild exaggeration, "writers should work hard so readers don't have to."

FANCY COMBINATIONS

Again like question factoring, both inductive and deductive presentation can be wielded at several scales throughout your document, and in combination. As an example, consider this section itself. The overall presentation is deductive; the two opening paragraphs introduce my top-level thesis (my assertion that inductive and deductive forms can be used to good effect), and this introduction is followed by subsections that flesh out the two forms, assess them, and advise on their use. Within this overall deductive presentation, I chose deductive presentations also for each of the first two subsections, even the one whose topic is inductive presentation! That subsection begins by motivating and defining the form. It follows with an example, and only then does it detail circumstances in which the form may be appropriate and why. But for the internal structure of the third subsection—the one whose topic is the general preferability of deductive form—I chose an inductive form. My hunch was that jumping right into the Paul Revere example would allow you to experience for yourself the feeling of reading a passage whose form is poorly matched to its purpose. I figured that with that experience under your belt, you'd be inclined to accept my thesis, which I was at leisure to build toward in the remaining four paragraphs.

Bottom Line

It's most often advisable
to spill your beans right up front
and follow with the details.

★7. Beware Noun-Noun Modification

There are several ways to modify nouns in English. The most obvious way is to use adjectives. For example, *rule* can become *golden rule*. Another way is with prepositional phrases, as in *rule of thumb*. A third way is to use other nouns as modifiers. An example of this is *mob rule*. Not every language permits such *noun-noun modification*: for instance, the French call mob rule *règne de la populace*, or reign of the masses. But in our language, using one noun to modify another is a common pattern. In fact, we think nothing of stacking our modifying nouns high, as in *city property tax rate*. But there is a trouble with nouns' modifying other nouns: like tribbles aboard the starship *Enterprise*, what starts out as appealing will quickly become nightmarish if allowed to multiply unchecked. And many authors do fail to exercise population control.

The problem with taking noun-noun modification too far is that, like breaching the known-new contract (see section 5), it makes readers wade through an ever-thickening soup of ideas, providing no relief until they've reached the far side, where—if they're lucky—everything suddenly firms up and makes sense all at once.

Some Examples

To see what I mean, consider one of the record holders in my private collection of noun-noun modifications (NNMs). It is the title of a technical report that I came across years ago: *Tank Car Head Shield Fatigue Performance Study*. Other collectors of NNMs murmur approvingly when they spot that specimen in my display case. One of its attractions is that it is an unsullied string of nouns; count 'em, seven! A common imperfection often seen in other NNMs is the inclusion of whole noun phrases among the nouns. A trophy that I recently added to my collection, and which I swear I caught in the wild, demonstrates such inclusions and other trace impurities but is scarcely less admirable for its flaws: *simulated engine high heat flux and high-pressure combustion environmental testing approaches*. Try if you dare to unravel the meaning from that beauty.

Next consider a more typical example of nouns gone wild, *multi- defense laboratory collaboration*. That phrase bears a telltale sign that its creator vaguely sensed something was amiss: it's that hyphenation that dangles in the breeze. No doubt the aim was to hitch *multi-* to something, but no good partner offers itself for the hitching. One can almost feel the reluctance with which the author decided to simply plow onward, abandoning that lonely hyphenation at the altar.

An Easy Solution

The great news is that even excessive noun-noun modification is treatable, and many cases can be completely cured. With one more example, we can come to understand the pathology, and this understanding will lead to a therapy. The phrase is *lag variability mitigation sub-effort*. One can, after moderate exertion, understand it to refer to an effort—one portion of a larger undertaking—to mitigate the variability of [some unspecified entity's] lag. The key observation is that this NNM has a simple structure: the sequence in which the ideas appear along the NNM is the exact inverse of their ordering in our decoded version. That same simple structure underlies all NNMs. Now remember that in any NNM, all of the nouns in the run-up to the last one are modifying that final

noun. So it's the final noun that is the base, the fundamental idea in the whole elaborate construct. That's why an NNM typically doesn't yield its meaning until you've reached its far side. And being fundamental, that final idea is likely to be the least surprising, so by the known-new contract it should be the first to appear.

Now the therapy is clear: in an excessive occurrence of noun-noun modification, you can simply invert the ideas from back to front. To make the final result a valid English utterance, you'll usually need to intersperse some prepositions and occasional verbs among the nouns, but that's an opportunity to make your meaning even clearer: the phrase *scrap metal box* might refer either to a box *for* scrap metal or to a box *made of* scrap metal, and a missile warning receiver provides warnings *of* missiles, not *to* them.

BUT DON'T BE A FIEND ABOUT IT

Allowing the ideas to revert to their rightful order and then leavening them with prepositions and verbs is very powerful. Still, it's not best performed completely automatically because some noun-noun modification really is a good thing—in most contexts, for instance, *missile warning receiver* is better than anything like *receiver that warns of missiles.* And a slavish approach would turn that ghastly report title, *Tank Car Head Shield Fatigue Performance Study*, into something like *Study of the Performance Under Fatigue of Shields for Heads of Cars With Tanks*. Clearly some substrings of the original title are noun phrases and should be retained as chunks. Doing so gives the much more reasonable and comprehensible *Study of Fatigue Performance in Head Shields of Tank Cars*.

Applied judiciously, the therapy solves even our infamous case of the dangling hyphenation. When you consider the ideas within *multi- defense laboratory collaboration* in their proper order, it becomes clear that using the prefix *multi-* just isn't the way to go. Instead, I would reword the phrase along the lines of *collaboration among defense laboratories*, which isn't even any longer than the original.

Bottom Line

Be wary of long strings of nouns.
When necessary you can unpack them by inverting them back to front.

★8. Use Nominalizations Sparingly

As we saw in section 7, overrelying on nouns can make one's prose seem sludgy. This kind of noun problem can also arise from the ability—essential to any language—to coin new words from existing ones. Such coining often starts with a word of one lexical class, or part of speech, and produces a word of some other class—the noun *house* gives rise to the verb *house*, meaning "provide living quarters to," and the adjective *hard* yields the verb *harden*. Perhaps the most often encountered of these changes in lexical class are the nominalizations, the transforming of other words into nouns. Everyday nominalizations are valuable: from the verb *direct* we have both *director* and *direction*, which provide names for the agent and the activity. But many technical authors employ nominalization quite carelessly, and the problem is that careless nominalizing generally bloats writing with unnecessary ideas, or unnecessarily abstract ones.

WHAT TO DO ABOUT EXCESSIVE NOMINALIZING?

A practice that is often helpful is to scan your writing for nominalizations and try to replace them with adjectives, or even better, with verbs. As an example, the sentence

> X *is a necessity in providing protection to* Y *due to the intrinsic high volatility of* Z

can be simplified, shortened, and clarified to become

> X *is needed for protecting* Y *because* Z *is intrinsically quite volatile.*

So long as we retain the first version's nominalization *protection*, we cannot manage without the extra idea of providing.

TWO REALLY BAD CASES

And retaining nominalizations is sometimes taken to remarkable lengths. One author, obviously grown numbly accustomed to using the term *data analysis*, actually encumbered the final version of a document with the sentence

> *Smith performed data analysis on the acoustic data.*

So long as we forget the perfectly good verb *analyze*, we cannot manage without the otherwise unnecessary idea of performing. How much clearer if he had written simply that

> *Smith analyzed the acoustic data.*

My last example of inappropriate nominalization is something special. It too is the product of an author in a rut.

> *Testing of various types of system by Dr. Jones was performed, which focused on…*

No doubt without realizing it, the creator of that fragment was absolutely wedded to the idea of testing as a phenomenon, a thing, an (admittedly abstract) object, so they overlooked that testing is an activity, thus what's called for is not a noun, but a verb. That fixation on the noun *testing* even explains why they put the prepositional phrase *by Dr. Jones* where they did (it would have fit more naturally after the verb phrase *was performed*): so long as we're stuck with the noun *testing*, everything about the testing, the of-what and the by-whom, has to show up before anything else could get in the way. Of course, gluing all of the of-what and by-whom right onto that noun left no place for a verb, which is a definite shortcoming in a sentence. That's why our poor old *perform* gets dragged in, relied on here as in the previous example to patch up poor workmanship.

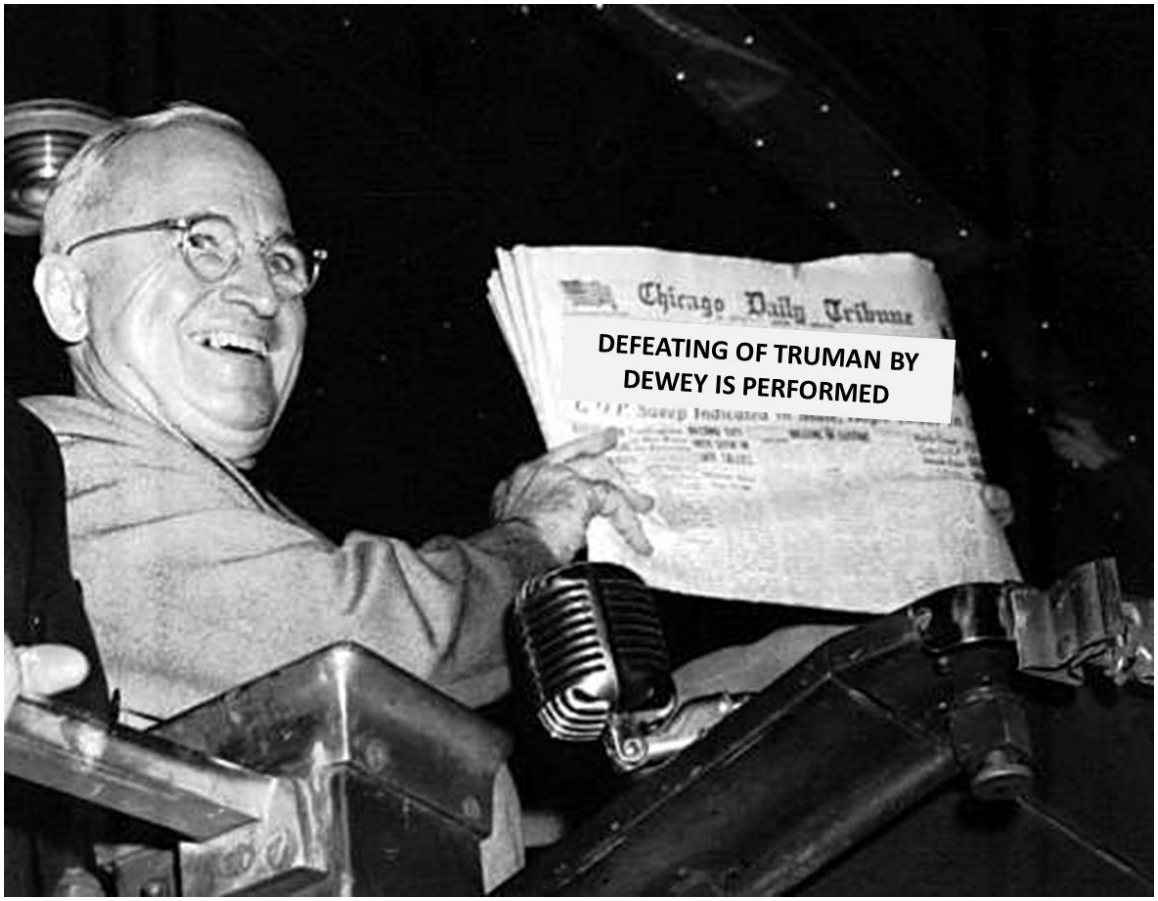

FIGURE 2.—Cause for rolling over in his grave by Joseph Pulitzer is provided.

A further problem with this example is that it offers no clear candidate for what is called the *antecedent* of its *relative clause*: who or what did the focusing? As readers encounter a relative clause such as "which focused on…," they begin a backwards scan for suitable antecedents, and that scanning gives lots of weight to recency of appearance. So in processing this example, readers try for at least a moment to make sense of the notion that perhaps the agent who did the focusing is none other than the abstract act of

performing. This would be parallel to what goes on in sentences like "Testing was halted, which delayed the program," or "Testing was filmed, which provided a video record." Causing readers to try out potential meanings, even momentarily, disrupts their concentration on your actual meaning.

Now that this example has been thoroughly autopsied, it need only be recast. I propose this simple revision:

Dr. Jones tested various types of system, focusing on…

Besides eliminating the contortions in the original, this version is much simpler and, what's more, its verbs, *tested* and *focusing*, even have the same subject: *Dr. Jones*.

Useful Warning Signs

If spotting nominalizations doesn't come easily to you at first, try looking for indirect evidence of their injurious effects. Often such verbs as *perform*, *provide*, *execute*, and *undertake* show up simply because some other perfectly good one has been nominalized. It is only to fill the void in a now de-verbed sentence that such stopgap verbs appear. But the stopgaps are quite blah in meaning and add little new information to the sentence: why "undertake an investigation of *X*" when you can simply "investigate *X*"? Globally searching for such blah verbs through a few documents will likely improve your skill at recognizing the undesirable nominalizations they so often abet.

Bottom Line

Names of abstract concepts often make for complex reading and poor sequencing. Try replacing them with the simpler verbs or adjectives from which they were formed.

An Absolutely Vital Irrelevant Digression

The word *nominalization* is self-referential. It comes from the Latin *nōmen* (a noun!) for name, by way of the adjective *nōmināl*is and then its English equivalent, *nominal*. The adjective gave rise in turn to the verb *nominalize*, and then someone chose to nominalize *nominalize*, yielding the nominalization *nominalization*.

And Another

Note that *nominalizing* is pentasyllabic. So is *pentasyllabic*.

9. Watch Ambiguity Surrounding *-ing* Words

Words that derive from verbs and end in *-ing* are handy, but when not used carefully they will often give rise to, or at least be implicated in, ambiguity. These *-ing* words can serve grammatically in either of two distinct roles—verbs or nouns—and in either capacity can contribute to unclarity.

AMBIGUITY FROM –ING VERBS

Their verb role, called the *present participle*, is often the more troublesome. Consider this sentence, which might be at home in a guerilla manual on how to foment trouble:

> *The key to increasing urban unrest is robust networks.*

Clearly, the word *increasing* is a verb and means "raising the amount of." But compare that sentence to this other from an oncology text:

> *The key to cancer no doubt lies in molecular biology.*

So maybe the sentence about urban unrest in fact comes from a civil-affairs manual, and the aim is not to foment trouble but to quell it. In that case, *increasing* doesn't mean "raising," but "rising"!

The problem with such ambiguous constructs is that context doesn't always make it obvious for readers which meaning is intended. When that happens, at best they have to juggle both meanings until they can solve the puzzle the writer has imposed on them. What's worse, they often miss the intended meaning and so proceed with the unintended one until later context eventually jolts them into adjusting their understanding. Or—worst of all!—they never detect the miscommunication at all and thus never correct it.

AVOIDING OR FIXING THIS PROBLEM

The key to eliminating the ambiguity in these cases is to use verbs denoting actions that are either clearly done *to* things (like *raise*) or clearly done *by* the things themselves (like *rise*); these two classes of verbs are called *transitive* and *intransitive*. The two new versions

> *The key to promoting* [or *pacifying*] *urban unrest is to develop robust networks*

do the job nicely. Another option that is prudent in these circumstances is to just swear off the present participles. So you could write

> *To increase urban unrest, the key is to develop robust networks*

or

> *To counter increases in urban unrest requires robust networks.*

AMBIGUITY NEAR –ING NOUNS AND WAYS TO FIX IT

Like the present participles, the *-ing* words that serve as nouns (called *gerunds*) are often found at the scene of ambiguity. Gerunds do appear in many sentences, such as

The combat data silenced all dispute about their skill at modeling

without incident. But consider this example:

She hopes to control malingering by ingenious methods.

To be fair, the word *malingering* is not itself involved in the crime. To acquit the poor gerund, notice that replacing it with something else, such as *theft*, doesn't fix a thing. No, the ambiguity stems from unclarity about what exactly is being modified by the prepositional phrase *by ingenious methods*. Does the ingenuity lie in her attempts at control or in the methods of the malingerers?

A surefire way of avoiding this kind of ambiguity is to rearrange the sentence. So consider reworking it along the lines of either

She hopes that by ingenious methods she may control malingering

or

She hopes to control even the ingenious malingerers.

Bottom Line

Words ending in *–ing* often cause
(or are found near sources of) unclarity.
Check whether readers may misinterpret.

10. Mind Your Hyphens and Their Brethren

Many authors stumble over where to hyphenate and how. And if you toss in the various dashes, it's not unusual to be at a loss. But the proper use of all this punctuation is not terribly difficult. To understand it, let's begin with the hyphen, whose use nearly always involves modifiers.

Using compound modifiers without taking adequate care can make it hard for readers to work out your meaning. Consider for instance the peril to Navy divers that is conjured by the phrase *a man eating shark*. That peril is entirely off topic if what the author means to discuss is a patron at a seafood restaurant. And other examples more apt, if less cute, are easily found. Does the first word in the phrase *long abandoned route* describe the duration of the path's disuse or the distance the path spans? These ambiguities all involve using modifiers *attributively*, which is to say without any linking verbs associating them with the phrases they modify. In contrast to phrases like *the route* **ended up** *abandoned*, attributive uses simply pile the modifiers right up against their modificands, almost always in front of them.

HOW TO USE HYPHENS

It is in resolving just such ambiguity of attributive modifiers that hyphenating finds its primary use. So the hyphen in the phrase *better-known method* clarifies that the method is more widely understood, rather than superior and already published. And one should hyphenate *six-week experiment*, though not *experiment lasting six weeks*.

The general rule to hyphenate modifiers used attributively does have exceptions, which all involve situations where confusing one's readers is unlikely. One is the adverbs ending in *-ly*, since they pose so little risk of ambiguity. So there shouldn't be a hyphen in *poorly trained recruit*, even though there should in its opposite: *well-trained recruit*. Another is borrowings from other languages: there is no hyphenation in *ad hoc method* because the Latin phrase is plain to readers as a single lexical unit. The same type of exception arises for technical terms, such as *silicon carbide ceramics*—the term *silicon carbide* is unambiguously a name (of a single chemical substance), so no hyphen is needed. By contrast, the phrase *lead-acid battery* does call for hyphenation because the meaning of its modifier is that the battery combines electrode and electrolyte, lead and acid. One final such exception to the hyphenate rule involves units in the SI system when you are using their symbols rather than their names. So, per the National Institute of Standards and Technology, you should not hyphenate the phrase *105 mm gun* even though you should hyphenate *35-millimeter film*. (I may as well add that one should not merely affix the unit symbol to a number: *105mm* is flat wrong.)

Where attributive modifiers are listed, you can reduce wordiness by leaving out repeated bits, but the hyphens should remain. Thus *before- and after-dinner drinks* and

We mounted the radar target on our 10-, 15-, and 20-meter towers.

Hyphenating does require some care because, as with so much else, one can get too much of a good thing. To avoid hyperhyphenating, remember to hyphenate only the modifier itself; don't also fasten onto it the thing being modified. Thus although there are correctly two hyphens in the sentence

They collected behind-armor-debris data,

there is only one in

They collected behind-armor debris,

and although there are two hyphens in the sentence

He performs system-of-systems analysis,

there is none at all in

He analyzes systems of systems.

Hyphenating a compound joins it for a single meaning. An even tighter association arises with solid compounds like *workshop*, which combine originally separate words into one. Occasionally, solid compounds show up in places that call for hyphenations. An example features the noun *underbody*, meaning the bottom elements of a vehicle. The example *underbody blast* rightly names blast on or affecting those elements. But we most often mean to refer to blast as it affects the entire vehicle and its occupants, not just its chassis and floor. Since our topic is blast originating under the body, the phrase is better styled *under-body blast*. It is analogous to *behind-armor debris*. A further analogy: in discussing the risk of sunburn even through light garments, most authors would regret writing of *undershirt inflammation*.

DASHES—THE LONG AND SHORT

With hyphens under our belt, we make quick work of the dashes. They come in two sizes, each with its own use, and neither should be confused with or interchanged with the hyphen. Both are available in any self-respecting word processor, though Microsoft Word doesn't make them particularly easy to access (find them under *Insert→Symbol*).

The larger version is the em dash, —, which is so named because its length is one em, in traditional typefaces the width of the upper-case *M*. It may be used to indicate a break in dialog or text, but its two commonest uses are to set matter off in much the same way you use parentheses, and to introduce an element that amplifies or explains a previous phrase. Thus

If we are overrun—heaven forbid!—Charlie Company will move in

and

Cracking the German naval codes was decisive—it finally slew the scourge of the U-boats.

Notice that there should be no spaces either side of the em dash. Although British English usage is to set em dashes *open*, which is to say with spaces before and after, in America it is the practice to set them solid.

The smaller of this pair is the *en dash*, – (guess where *its* name comes from!). It finds its primary use in enumerations of ranges. Thus the era of the VHS tape might be formulated as "1977–2005" and a business's work week as "Monday–Saturday." Since a construction like "*A*–*B*" means between *A* and *B* or from *A* to *B*, the spelled-out and the en-dash forms should not be mixed. There is no call for hybrids like *Shinseki was chief of staff from 1999–2003*.

NOT TO SEEM TOO NEGATIVE…

There is one more symbol that often enters this mix: the minus sign. The hyphen in an expression like

$$\sin 3\pi/2 = -1$$

is flat wrong. In any document you actually care about, achieve the right effect by using the true minus sign:

$$\sin 3\pi/2 = -1.$$

Bottom Line

Use hyphens in temporary compounds serving as adjectives before nouns: *a fast-moving van*.
Use em dashes mainly to denote breaks or parenthetical insertions.
Use en dashes mainly to indicate ranges.

11. Don't Capitalize Before Abbreviating Unless…

There is a practice that, though widespread, is nonetheless incorrect. Many authors have the impression that when they introduce a term they're about to abbreviate with what's called an initialism (like RPG or ASAP), something demands that they capitalize the words they're about to abbreviate. Let's call this practice *unwarranted pre-abbreviational capitalization*, or *UPAC*. Note that *unwarranted* is the key: none of the three words represented in the initialism *UPAC* is capitalized in the previous sentence. Yes, the initialisms do belong in all caps—or perhaps in mixed case, which gives lesser emphasis to non-key words, so we might write either *DOD* or *DoD*. But the mere fact that a phrase is about to be abbreviated is not grounds for capitalizing the phrase itself. So unless it is in a title or there is some other reason, a term like *system of systems* should not be capitalized.

The proper practice is described well by the *Chicago Manual of Style Online*: "In the spelled-out version, simply cap as you would if an initialism did not exist: standard operating procedures (SOPs), Rhode Island (RI), *American Journal of Education* (*AJE*), Mothers against Preschoolers (MAP)."

Some might be tempted to defend UPAC as a means of highlighting the act of abbreviating. But, really, replacing *system leader* with its abbreviation *SL* is not so subtle an act that readers will need you to elucidate it.

Bottom Line

When you are about to abbreviate something, capitalize it just as though you weren't.

12. Watch Your Spelling and Word Choice

Future historians of the turn of the twenty-first century may conclude that one of today's greatest obstacles to careful writing is the automatic spelling checker. Too many authors seem to believe that clicking that button relieves them of the need to proofread their writing carefully. Too many authors who would never dream of using the word *Graham* in expressing a measure of mass would nonetheless be content writing the first word of this very sentence as *to*.

Certainly, spelling—like all features of language—is a social convention that is forever changing. Many of its rules are gradually discarded and forgotten as new ones arise, and to some extent each one is a matter of judgment. I offer here some advice on making such judgments.

To begin with, do make such judgments. Even if spelling has never come easily for you, many of your readers will notice it. It's never good to leave people wondering if you wish to be taken seriously, or if slip-ups indicate that you lack interest in the subject or you lack respect for the audience. Here's an analogy: when giving an oral presentation, although you might not dress formally, you'd be sure not to wear a shoe on one foot and on the other a bedroom slipper. Just so, it's wise to take some care in your writing.

Six Pairs Not to Misuse

Here are a few examples of words that are commonly misused; you should be on the lookout to avoid stumbling on them or the many others like them. Far more exhaustive lists are available from many references, including Bryson's (see the annotated bibliography).

1. *Complimentary* does not describe the relationship between the two parts that constitute some whole unless they spend their time praising others. The sense of completing or making up a whole is correctly conveyed by the word *complementary*.
2. The word *lead* that rhymes with *bed* is neither a past tense nor a past participle, but the name of a metallic element denoted by the symbol Pb. When you wish to discuss having guided or caused, the right word is *led*.
3. The verb *lay* denotes what chickens do to eggs, or the act of placing, as for depositing a book on a table. In particular, to lay low is to bring to ruin. It is only when we *lie* low that we are trying to avoid detection. Indeed, the verb pair *lay-lie* is perfectly parallel to several others that refer to changes of position, including *raise-rise*, *seat-sit*, and even *fell-fall*. The first of each pair—called *transitive*—deals with actions carried out upon other objects. The second concerns actions that actors carry out upon themselves; such verbs are called *intransitive*.
4. The verb *insure* has to do with protecting against loss. If we have arranged matters so as to make some condition inevitable, then the condition has been ensured.
5. Describing something as *stationery* links it with pens, paper, and such supplies for the writing desk. If instead you wish to call it unmoving, then your word is *stationary*.

6. *Principal* describes someone or something that is chief or most important. To write of a doctrine, rule, or philosophy, one uses the word *principle*. Keeping these two words straight is easy if you remember, just as your second-grade teacher taught, that "the principal is your pal."

PSEUDORULES

But matters are not always as simple as those examples might suggest: no rule is absolute, and some have authority that is downright feeble.

Here are five examples of rules that have less compelling claim on our obedience than the previous batch. But before choosing to ignore them—even those whose origins are recent and arbitrary—you should consider that some of your readers will disapprove. Only you can decide whether that is a cost you wish to bear in order to "be yourself."

1. At least since the sixteenth century, there has been a distinction between *imply* and *infer*, with the former meaning to express indirectly or entail and the latter meaning to conclude from observations or premises: the speaker implies and the listener infers. But many careful authors use *infer* in both senses. On the other hand, many readers respect the distinction and wish it to be observed. And the distinction does offer useful precision.
2. Similarly, today *disinterested* means impartial and *uninterested* means indifferent or uncaring. But over the years these meanings have bounced around between the two words. It's advisable to use this pair only in their currently preferred senses.
3. Next comes the famous feud: *data is* or *data are*? In Latin, *data* is the plural of *datum* (which, if you must know, is the neuter perfect participle of *dare*, to give), and in English *datum* means a single measurement or fact. A datum is a given. So, when referring to such discrete measurements or facts, one is safe to call them *data*. But the English *data* is used also to mean an undifferentiated collection of information: many writers feel it is more natural, when discussing a scarcity of experimental results, to report that there isn't much data, rather than that there aren't many. I count myself among them in seeing *data*—when it's used in this mass sense—as a singular noun. When people argue that because *datum* is its singular, therefore *data* must be plural, I reply that a single strand of pasta is, in Italian, a *spaghetto*, but that I've never heard anyone brag about how many spaghetti they've eaten. And if we stick with a purely English example, the argument becomes even clearer: as its form suggests, our word *news* started out plural, applying to recent happenings. But do we report that "the news are good"?
4. Some borrowings from Latin are unlike *data*/*datum* in that there is no cause to use their plural forms as if they were singular. For example, the term *media* comprises TV, newspapers, the web, and other things, each of which is a medium; if you give up one of two criteria you are left with one criterion; a triangle has three vertices, and each by itself is a vertex. But even here things get uncertain. If you hold a discussion forum daily, do you have to spend your week in fora, or does *forums* sound better?

5. *Comprise* means to include; it's close kin to *comprehensive*, meaning "very inclusive." So a whole comprises its parts. Inversely, how should you describe the making up of that whole by its parts? Because the parts are its constituents, the verb for that is *constitute*: the nine justices constitute the Supreme Court. Finally, there is no need for "is comprised of"; even those who feel compelled to use some construct of the form *is-X-of* have a better option: the transport layer is composed of such protocols as TCP, UDP, and SCTP. And perhaps better yet is to just state straightforwardly that it comprises them.

As to the spelling checker, remember that it does little more than detect the use of words that are not in its own list and flag duplicates like *the the*. All the examples above involve using not a nonword but the wrong word, and the spelling checker won't often catch that. Nor can we expect it to help with the sensibleness of our writing: it will be perfectly satisfied with a sentence like "Colorless green ideas sleep furiously." And it does not detect many sins of omission: "Mary had little lamb" won't trigger the least whimper of complaint.

All that being said, the spelling checker is not useless. Typos do happen, and many of them are within its abilities to trap. Since many programs offer to run the checker automatically, it's surprising how many obvious typos make it into prynt.

Bottom Line

Careless spelling turns many readers off.
Use, but don't rely on, the spelling checker.

13. Don't Underline More Than Once a Year

Underlining is an outdated practice. It dates to the days of manuscript, and *manuscript* in its literal sense means handwritten document. Authors underlined bits of copy as an instruction to the printer that those bits should be typeset in italics. And this practice quite naturally carried forward into the era of typewriters.

As the advent of document processing ushered in so-called desktop publishing, the developers of this software aimed to impress their users through a misguided notion of the power of these tools. Scurrying for market share, they rushed to implement an entire rummage sale's worth of features beyond what was offered by all those fusty old typewriters. I'm convinced that the main reason that Microsoft Word offers italics *and* bold *and* underlining *and* shadows *and* strikethrough is that typewriters couldn't.

But keep in mind that features are not the same as benefits: the cupboard may contain a couple dozen spices and herbs, but that doesn't mean you have to apply them all liberally to your next batch of butter cookies. Similarly, since it has become easy to italicize, there is seldom cause for underlining—look at any good-quality book and note how little underlining it contains. Bolding is somewhat more often appropriate, but the rest of the bells and whistles should be avoided. Professionalism calls for some restraint.

So, as for italicizing, in what situations is it appropriate? The primary examples are:

1. Names of publications: "S. Nair, *Introduction to Continuum Mechanics*, 2009."
2. Mathematical variables and single-character names of functions: "$f(x) = e^{2x}$" and "sin θ."
3. Introductions or definitions of terms: "One common denial-of-service attack is the *ping flood*, which overwhelms its target system with ICMP packets."
4. References to phrases themselves, rather than to the things they refer to: "London is a city, but *London* is a six-letter noun."
5. Phrases being emphasized: "Word offers italics *and* bold *and* underlining…" But use this sparingly. One usually achieves the desired emphasis better by word choice or order than by typographical means. Furthermore, research in visual cognition indicates that italicizing text in fact reduces its visual prominence, so its effect for emphasizing derives only from its difference in appearance from the surrounding text.

Boldface is another means of emphasizing. But its visual strength makes it seem to me like shouting, so I recommend you use it very sparingly. One situation that does affirmatively call for boldface is the setting of mathematical vectors: "For the midterm, be prepared to discuss the significance of Newton's second law, that $\mathbf{F} = d(m\mathbf{v})/dt$."

Bottom Line

Underlining generally clutters and is not needed.
Italicizing serves most purposes,
together with occasional boldface.

14. Generate Email That's Worth Reading

Some of the commonest writing tasks in our work world are for products of such small scale that it's easy to forget that they, too, are worthy of care in their preparation. A key example is email messages. Of course, nobody should obsess for hours over a one-paragraph note to their team leader or colleagues. But the techniques for achieving clarity and impact in long documents are just as applicable to short ones, and on small jobs they can be wielded much more quickly and easily. Here are some pointers that show those now-familiar techniques applied in the particular context of email.

A Subject Line Is A Terrible Thing to Waste

Simply by creating a good subject line you can accomplish three very important things. First, you can give the recipients of your email an accurate and pithy encapsulation of its purpose. This gives them a fair shot at assessing when—and whether—to read the message. You yourself get lots of email that you'd be better off ignoring; surely you send some messages, too, that some recipients do not truly need to leap right onto. Second, you might be surprised how often it's possible to create a gem of a subject line that conveys the information so thoroughly that most readers don't even need to see the message's body. That kind of subject line allows you to tailor the body to address the special requirements of those few recipients who desire additional detail or further convincing. And finally, a good subject line is a very valuable aid in sorting and retrieval. Since many messages are not just read once and then deleted, you should think both of your readers' first encounter with your message and also of the chance that they'll need to find and use it again two years hence.

That takes care of subject lines for those messages made up of 100%-virgin material. But what about all the email consisting of a sentence or two tacked onto some forwarded traffic? For all the same reasons, do not be afraid to apply new subject lines when forwarding. It's true that in this situation there is a trade off. It's certainly nice to have all the messages of a single conversation (or thread) share a single subject line; for one thing, it makes it easy in Outlook to step forward and back through a "conversation topic." But the initial choice of subject line may not have been so great, and you're not stuck with it. And even if the subject line was appropriate to the beginnings of the exchange, it may have become obsolete if the thread has wandered off onto a new topic.

It can make sense to replace a subject line even when you're merely responding to a message. If you've received email with subject "Re: ATEC MRAP Test Requirements" that turns out to be an invitation to a meeting, your reply can have a better-chosen subject line than the invitation did. Consider something like "Can make 16 Nov IPT for MRAP."

Get to the Point

Most work email should be short and sweet. Even if you can't fit everything that needs saying into your subject line, arranging your thoughts from most important to least allows recipients to read as much as they need and then stop. In the words of section 6, present your message in a deductive form. Inductive presentation has its place when you want to achieve a dramatic effect and avoid spoiling the suspense. But how many of your emails really call for suspense?

Especially in a smaller-is-better context like email, many readers will experience an inductive presentation as expecting them to invest their time and attention on spec, with the hope—but no assurance—of eventual reward. You may avoid readers' resentment by not obliging them to delay their gratification.

Avoid Grab Bags

If you have several nearly unrelated points to make or questions to ask, parcel them out into separate messages. This has various advantages. First, it gets you writing shorter messages. And the single-topic-per-email approach also eliminates the risk that users' uninterest in your first topics will lead them to stop reading and thus miss subsequent points. This modular approach also keeps things cleaner for recipients, who might need to forward or otherwise handle each of your various points in its own way.

Be Discreet

As a practical matter, it's wise to keep in mind where your email messages may end up and what effects they may have. This counsel is often expressed via the admonition not to commit to email anything that you would not wish to appear on the front page of the *Washington Post*. However confident you may be in your addressees and their discretion, it is a fact that email often finds its way to the in-boxes of parties far beyond its originator's intentions.

Sometimes we fail to consider the potential impact of our email even on our own addressees. Once, early in my career, I had a complaint against a coworker and sent email to similarly aggrieved colleagues, all of our branch chiefs, and the division chief. Although I had not thought my note intemperate, it did get some people hot, and it led my boss to offer very good advice: "Don't go out of your way to make enemies."

Bottom Line

Make your email simple, concise,
and free of unintended incitement to riot.

Annotated Bibliography

1. W. Bryson. *Bryson's Dictionary of Troublesome Words*, Broadway Books, New York, 2002.

   A slender volume whose subtitle describes it as "a writer's guide to getting it right," Bill Bryson's book briefly defines its entries and offers prudential counsel about how to use them.

2. K. Dungey and H. Lillywhite. *High-Impact Technical Writing*, Quality Communications Group training materials, Baltimore, 2009.

   Drs. Dungey and Lillywhite have provided several iterations of training for SLAD on effective writing. They present very informative and helpful methods for thinking about writing in a unified way. If they'd done nothing else, they should be lauded for their influence on a student, Eric Edwards, one of the most talented copy editors I've had the pleasure to work with.

3. E. Gowers. *The Complete Plain Words*, David R. Godine, Boston, 1988.

   A career civil servant in the UK, Sir Ernest Gowers wrote several style guides that, though intended for use within the British government, proved popular and influential for a much wider audience. From his first-hand acquaintance with the dreaded officialese to which we government employees are susceptible, Gowers provides sound advice on making oneself understood. He sizes up his audience thus: "'Even now', they may say, 'it is all we can do to keep our heads above water by turning out at top speed letters in which we say what we mean after our own fashion. Not one in a thousand of the people we write to knows the difference between good English and bad. What is the use of all this highbrow stuff? It will only prevent us from getting on with the job.' But what is this job that must be got on with? Writing is an instrument for conveying ideas from one mind to another; the writers' job is to make the readers apprehend the meaning readily and precisely."

4. P. J. Tanenbaum. *Guidance for Preparing Your CASE Package*, United States Army Research Laboratory, 2006. Available: ‹https://arlinside.arl.army.mil/inside/toolkits/case/CASEHintsII.doc›, 8 March 2010.

   This ARL-wide resource obviously has a fairly focused purpose. It comes highly recommended for those engaged in seeking promotion through the CASE process. Its spirit and larger aims are very similar to my approach here, and its advice—despite its special purpose—is applicable to, and probably valuable in, writing more generally.

5. A. Thompson and B. N. Taylor. *Guide for the Use of the International System of Units (SI)*, National Institute of Standards and Technology Special Publication 811, Gaithersburg, MD, 2008. Available: ‹http://www.nist.gov/physlab/div842/fcdc/upload/sp811.pdf›, 8 March 2010.

Thompson and Taylor provide thorough and precise instruction on an element that is critical to the kind of writing we produce. Because they constitute the horse's mouth, their guidance may be considered absolutely authoritative—why settle for less?

6. E. R. Tufte. *The Visual Display of Quantitative Information*, Graphics Press, Cheshire, CT, 1983.

For designing communications for effectiveness, this is surely one of the most valuable books in existence. Its explicit topic is graphical presentation, so some might conclude that it applies only to the figures in their reports or to the slides in their briefings. But the principles that Tufte espouses and his manner of conveying them—down to the quality of the stock on which the book is printed—can guide you by analogy in the crafting of your prose.

7. J. M. Williams. *Style: Toward Clarity and Grace*, Univ. Chicago Press, Chicago, 1995.

Joseph Williams performs a great service with this book. While such gems as Strunk and White's *Elements of Style* offer much sound and beautiful advice, they don't manage to provide an overarching framework for really *getting* what makes bad writing bad or what's so good about good. I find in this book a viewpoint for understanding that art form and a language for diagnosing prose more precisely—and thus more helpfully—than hazy verdicts like "that passage is awkward; make it clearer." A masterly highlight is Williams's explication of what Jefferson was actually up to as he crafted the Declaration of Independence.

8. ———. *Style: Ten Lessons in Clarity and Grace*, Pearson Education, Inc., New York, 2005.

Another similarly valuable volume by Williams, this one is less of a discourse than the previous work. It has more the feel of a straightforward how-to guide, complete with lots of helpful exercises.

9. W. Zinsser. *On Writing Well*, HarperCollins, New York, 2006.

Large stretches of this classic are not directly applicable to the kinds of technical or business writing we are called on to do: it includes chapters on memoirs, sports writing, art criticism, and humor. But elsewhere it offers much wisdom.

Reviewing the decades leading up to this 30th-anniversary edition, William Zinsser describes how the advent of the word processor has changed things: "Two opposite things happened: good writers got better and bad writers got worse. Good writers welcomed the gift of being able to fuss endlessly with their sentences—pruning and revising and reshaping—without

the drudgery of retyping. Bad writers became even more verbose because writing was suddenly so easy and their sentences looked so pretty on the screen. How could such beautiful sentences not be perfect?"

Another among Zinsser's many pearls is this: "The man or woman snoozing in a chair with a magazine or a book is a person who was being given too much unnecessary trouble by the writer." We might augment his list of sleep aids with "technical report or CASE package."

10. *Style Manual*, United States Government Printing Office, Washington, 2000.

Dry as it may seem, this work is valuable. In a sense, it is the foundational reference for any publication of the Federal Government. Although we here may not need to know how to typeset records of congressional hearings or draft legislation, the GPO provides in this book a wealth of examples on correct form for capitalizing, compounding, abbreviating, and the like. But the editors have, inexplicably, dropped one great feature from recent editions: the section on foreign languages. On those rare occasions when I must ensure that I've correctly handled a scrap of German or Russian—did you know that *BMP* stands for *Боевая Машина Пехоты*, literally *infantry fighting vehicle*?—I have to fall back on my trusty 1984 edition. Or on Chicago (*vide infra*, and don't resort to foreign phrases when their English equivalents will serve).

11. *The Chicago Manual of Style*, University of Chicago Press, Chicago, 2003.

Perhaps the mother of all style guides, Chicago answers most any question, and its answer is almost always the simplest and most graceful choice. Of course, in many such matters there is no *right* answer, but heeding this book's guidance is almost guaranteed to keep you out of trouble.

1 (PDF only) DEFENSE TECHNICAL INFORMATION CTR
DTIC OCA
8725 JOHN J KINGMAN RD
STE 0944
FORT BELVOIR VA 22060-6218

1 HC DIRECTOR
US ARMY RESEARCH LAB
IMNE ALC HRR
2800 POWDER MILL RD
ADELPHI MD 20783-1197

1 HC DIRECTOR
US ARMY RESEARCH LAB
RDRL CIM L
2800 POWDER MILL RD
ADELPHI MD 20783-1197

200 CDs DIRECTOR
US ARMY RESEARCH LAB
RDRL CIM P
2800 POWDER MILL RD
ADELPHI MD 20783-1197

14 HCs US ARMY RESEARCH LAB
RDRL LO DAWN GOLAB
2800 POWDER MILL RD
ADELPHI MD 20783-1197

55 HCs US ARMY RESEARCH OFFICE
RESEARCH TRIANGLE PARK
RDRL ROS WANDA WILSON
BLDG 4300
DURHAM NC 27703

12 HCs US ARMY RESEARCH LAB
ATTN RDRL SLE W MARILYN MCCUSKER
BLDG 2700 MYER CENTER
FT MONMOUTH NJ 07703-5602

284 HCs US ARMY RESEARCH LAB
RDRL CI JAMIE MCLAUGHLIN
2800 POWDER MILL RD
ADELPHI MD 20783-1197

323 CDs US ARMY RESEARCH LAB
ATTN RDRL SEG SHARON SANCHEZ
2800 POWDER MILL RD
ADELPHI MD 20783-1197

120 HCs US ARMY RESEARCH LAB
ATTN RDRL SLE BETTY SMITH
WHITE SANDS MISSILE RANGE
BLDG 1624
WHITE SANDS MISSILE RANGE, NM 88002-5513

62 HCs US ARMY RESEARCH LAB
ATTN RDRL VTS HENRY RUSSELL
NASA LANGLEY
BLDG 1244C
HAMPTON VA 23681

ABERDEEN PROVING GROUND

1 HC DIR USARL
RDRL CIM G (BLDG 4600)

142 HCs US ARMY RESEARCH LAB
RDRL HRG DOUGLAS JOHNSON
BLDG 459

157 HCs US ARMY RESEARCH LAB
RDRL SL GRETCHEN BAKER
(132 copies)
RDRL SL PAUL TANENBAUM
(25 copies)
BLDG 328

367 HCs US ARMY RESEARCH LAB
RDRL WM TANYA WADE
BLDG 4600

TOTAL: 1740 (1 ELEC, 523 CDs, 1216 HCs)

INTENTIONALLY LEFT BLANK.