Economy and Clarity in Writing Scientific Reports and Papers

Roman scholar and naturalist Pliny the Younger once wrote, “I apologize for the long letter; I didn’t have time to shorten it.” Writing that is wordy and rambling is a sign of a writer who is careless and in a hurry, or a writer who does not know better. There is no better advice than that from Henry David Thoreau:

_Simplify, simplify, simplify!_

which is illustrated in the Bill Watterson comic to the right. Scott Adams (creator of the _Dilbert_ comic) takes this a step further:

_I took a two-day class in business writing that taught me how to write direct sentences and to avoid extra words. _Simplicity makes ideas powerful._ Want examples? Read anything by Steve Jobs or Warren Buffett._

Our writing journey begins and ends with simplicity in mind because the best technical prose uses language economically. In fact, the hardest thing to do in technical writing is to communicate complicated information in a condensed manner that a reasonably educated person can readily understand, but that is our challenge! Clear writing is a sign of clear thinking and hard work. This style guide discusses how to write economically and clearly by avoiding _verbal sludge_ and lazy clichéish phrasing.

**Rule 1—Redundant Pairs**

Whenever possible, substitute one word for several and avoid needless repetition. There is no need to use multiples of words that essentially mean the same thing as in the examples:

- each and every → each
- thorough and complete → thorough
- basic and fundamental → fundamental
- final and conclusive → conclusive
- soil material → soil
- separate and distinct → distinct

**Wordy:** Recycling and reuse of waste material is a topic of global concern and of great international interest.

**Concise:** Recycling of waste is a topic of global concern.

**Rule 2—Redundant Modifiers**

In many phrases, one of the terms implies the other. Eliminate the unnecessary modifier as noted below:

- future plans → plans
- actual experience → experience
- final conclusion → conclusion
- close proximity → proximate
- plan in advance → plan
Rule 3–Redundant Categories

In certain phrases, one term is in the general category to which the other term belongs. Again prune what is unnecessary as in the examples which follow:

- rough in texture → rough
- month of January → January
- light blue in color → light blue
- rectangular in shape → rectangular

*Example:* Poorly Graded Sand (SP), *pale brown in color*, moist, loose, fine sand is stated better (and specifically) as Poorly Graded Sand (SP), *pale brown* (5YR 5/2), moist, loose, mostly (70%) fine sand

Rule 4–Noun Strings

Resist the tendency to put a long string of nouns together in which one modifies or restates the ones that follow. Whenever you see a series of two or more nouns strung together, consider rewriting by adding a verb or hyphenating if the nouns are unit modifiers. For example,

*Replace:* We will develop a *strategy approach concept* for the experimental plan.

*with:* We will develop a *strategy* for the experimental plan.

*Replace:* Calcium precipitates have altered the *natural leachate flow pattern*.

*with:* Calcium precipitates have altered the *natural pattern of leachate flow*.

Rule 5–Surplus or Non-Specific Intensifiers

While we tend to use intensifiers like adverbs ending in –ly to emphasize or add power to our everyday speech, often such language zaps the strength out of the words it modifies. In technical writing, we need to be judicious when using intensifiers; for example, drop the intensifiers in the following word pairs:

- absolutely pointless → pointless
- completely opposite → opposite

Be leery of non-specific intensifiers, such as *very, relatively, large, high, low,* and *significant*. After reading the sentence “A *small increase* in the amount of RCA will have *large* economic and environmental benefits,” the reader cannot be expected to understand what *small or large* means in this context. Accordingly, the above example requires substantial revision. Some examples of corrections to non-specific intensifiers follow:

*Replace:* Recycled concrete aggregate has a *very* alkaline pH.

*with:* Recycled concrete aggregate is highly alkaline (pH > 12).

*Replace:* Four *large* columns were constructed.

*with:* Four large-diameter (20 cm) columns were constructed.

*Replace:* The water content is *significantly higher* in the clay than in the sand.

*with:* The water content is higher in the clay (25%) than in the sand (12%).

*or:* The average water content is significantly higher in the clay subset (25%) than the sand subset (12%) (p-value = 0.02 < 0.05).

Note that the non-specific intensifiers are replaced by sentences with specific values that give the reader context for the modifiers’ meaning.
Rule 6–Expletives, Empty Expressions, and Overuse of Prepositional Phrases

Expletives are short expressions such as “it was” and “there are” that function like starting blocks for pushing off into a sentence. These are examples of overuse of the verb “to be” which demonstrates a laziness of thought, creates dullness in prose, and delays the core assertion of the sentence as in the following example:

Replace:  
It is necessary to add the acid to the water…

with:  
Acid must be added to the water…

Habitually using “It is,” “There is,” or “There are” at the beginning of sentences or clauses can give your writing a tedious rhythm, making your writing sound amateurish and flat. Furthermore, you do not need to pad your writing with words that do not add to the meaning. For example, why write “in the event that” when you can write “since”? Avoid the overuse of prepositional phrases such as the following:

- In order to → To
- Due to the fact that → Because
- At this point in time → Now
- In close proximity to → Near
- For the purpose of → For

Rule 7–Overuse of Weak All-Purpose Verbs

By overuse of weak all-purpose verbs, we mean verbs like are, deal with, hold, have, involve, do, etc., which tend to lead to wordiness. Build sentences around stronger action verbs.

Replace:  The team will hold a meeting on September 20th at 9:00 a.m.

with:  The team will meet on September 20th at 9:00 a.m.

Rule 8–Passive Voice Construction

The last problem—passive voice construction (e.g., the ball was thrown by the boy rather than the boy threw the ball)—is particularly omnipresent in technical writing because scientific writers want to appear more objective and would rather not place the emphasis on the actual doer of the action. The below sentence is representative of onerous use of passive voice:

Replace:  An investigation of the Yucca Mountain site was conducted by the federal government for the purpose of determining whether the reported faults making the site prone to earthquakes would make it a somewhat unsafe location for contaminated nuclear materials.

With:  The federal government investigated whether the reported faults making Yucca Mountain prone to earthquakes made it unsafe for contaminated nuclear material.

Avoid extensive use of passive voice to eliminate wordiness, choosing active voice instead. To clarify further, verbs have two voices: active and passive. “Voice” pertains to the way a verb functions relative to the subject of the sentence. With the active voice, the verb’s action is linear and straightforward. The sentence’s movement is subject → verb → object as in “The report [subject] summarizes [verb] our findings [object],” However, what would be the subject in a sentence using an active verb becomes the object in a sentence using passive voice. The movement in passive voice is instead object → verb → subject as in “Our findings [object] are summarized [verb] by the report [subject].” The active voice usually requires fewer words and is easier to read because the active voice takes the reader from point A to point B in a straight line.
Passive: The facility data were provided by the Department of Energy.
Active: The Department of Energy provided the data.

Passive: The report was reviewed by Dr. Benson.
Active: Dr. Benson reviewed the report.

Thus, in our technical prose, choose active voice (subject performing action) rather than passive voice (the subject is the object of the action) because it conveys more directly who does things, or that things happen, and it reveals who or what does so.

Source: Bill Watterson, Calvin & Hobbes.

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