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Common Grammar, Usage, and Punctuation Problems

David McMurrey

Chapter Objectives

Upon completion of this chapter, readers will be able to:

1. Explain and apply essential punctuation rules.
2. Explain and apply essential grammar rules.
3. Explain and apply essential capitalization rules.
4. Explain and apply essential numbering rules.
5. Explain and apply essential symbol and abbreviation rules.

Common Grammar, Usage, and Punctuation Problems

In this chapter, we will cover only those grammar, punctuation, usage, and spelling problems that give people the biggest headaches.

Technical writing professionals try to simplify grammar rules as much as possible without hurting the language or putting themselves in straitjackets. Typically, they work in teams and frequently move in and out of projects—so that the same document may be worked on by different writers and editors during the space of just a few years. That's why any guidelines based on interpretation or personal style or judgment must be avoided.

Commas

Punctuation is a good example of this effort to use clearly defined rules in technical writing. In journalistic punctuation style, you punctuate according to what you feel are the needs for clarity. But punctuating that way is likely to be viewed differently by different people. Therefore, punctuation style in technical writing is based on the *structure* of the sentence.

Introductory Elements

Use a comma after all introductory elements. *Any* element, regardless of length, coming before the main clause should be punctuated with a comma. (The main clause is that core part of a sentence that makes it a complete sentence; that is, it expressed a complete thought.) Here are some examples:

When an atom acquires enough energy to leave its orbit, the atom is positively charged.

As for the energy required to produce plastic automobile parts, the auto makers view the additional cost as justified by the savings in petroleum by a lighter car during its lifetime.

Because the high-pressure turbopumps rotate at speeds of 30,000 rpm, the weight distribution on the turbine blades must be balanced with great accuracy.

Because there is no belt of doldrums in the Atlantic south of the equator, hurricanes do not usually occur there.

Between 40 and 50 degrees west and just south of 10 degrees north in the western end of the doldrums belt, calms do occur with frequency, and hurricanes originate there with great frequency.

In 1831, Michael Faraday discovered that if a magnet were moved in the vicinity of a coil, a current could be induced in the coil. (Punctuate even short introductory phrases like this one and the next two sentences.)

Using this concept, Faraday arrived at a relation between the changing flux and the induced electromagnetic field.

Today, the computer consortium of IBM, Motorola, and Apple is announcing its new PowerPC chip.

Unnecessary Commas

Double check commas between parts of a sentence. A single comma should never break the flow of the main subject, verb, and object or complement of a sentence. Instead, commas should occur in pairs. Here are some examples (the bracketed commas indicate where commas are typically but mistakenly placed):

The discovery that moving a magnet within a coil could produce current[,] was a major breakthrough in the history of electronics. (Yes, it's a long way from the subject "discovery" to the verb "was," but there should be no comma.)

Decreasing the radar operating frequency[,] increases the effective velocity coverage for the same sampling rate. (The whole phrase "decreasing the radar operating frequency" is the subject of the verb "increases"--no comma.)

It can be assumed that[,] precipitation particles move with the air in their environment and are, therefore, good tracers for air motion. (Don't know why people would put a comma here--does it feel like a pause?)

The separator between black mix and the zinc electrode[,] consists of a paper barrier coated with cereal or methyl cellulose. (No comma here either.)

That European refuse incineration costs are substantially lower than U.S. costs[,] is particularly evident when income from by-product recovery and salvage operations is included. (The whole clause, "that European refuse incineration costs are substantially lower than U.S. costs," is the subject for the verb "is"--no comma.)

Compound Sentences

Use a comma between all independent clauses. Whenever you have a compound sentence (those are the ones joined by *and*, *but*, *yet*, *or*, *not*, *for*, *whereas*), put a comma before the conjunction (the words I just listed). The length of the compound sentence does not matter. Here are some examples:

The tank is made of aluminum, but the outer surface is protected by a spray-on foam.

By the mid-1970s, the free-spending ways of the Apollo program were gone, and NASA now had to grapple with large technical challenges on a limited budget.

It first appeared that Hurricane Betsy would reach the eastern U.S., but a looping path took her around the tip of Florida and into the Gulf instead.

Gamma rays produce few pairs, but they travel farther.

One grate turns at 50 mph, but the others turn at 15 mph.

Type your name, and then press the Enter key.

You should type your name and then press the Enter key. (In this case, "you" is the subject for the compound verb--it's the subject for both "should type" and "press." This is not a compound sentence, and therefore there is no comma before "and.")

Compound Predicates

Do not use a comma between two compound verb phrases. Watch out about what you think are compound sentences. A complete sentence has to be on both sides of the conjunction (that means subject, verb, object, or complement--the works). Compare the following examples.

Offspring exposed to significant amounts of alcohol in utero are much more active than controls[,] and sometimes seem to fly around the room. (This is a compound verb phrase, not a compound sentence: "offspring" is subject for both verbs.)

Plastic parts are not weldable[,] and must be repaired by other methods.

The observation and measurement of such small frequency shifts require excellent radar frequency-stability characteristics that are not usually found in conventional radar[,] but can be added without a drastic increase in equipment costs.

Pulse Doppler radar effectively samples the backscattered signal at the radar repetition rate[,] and therefore can provide unambiguous Doppler frequency observations only in the frequency range allowed by the sampling rate.

The manganese dioxide used in batteries is usually obtained from natural ore (mainly from Gabon, Greece, and Mexico) [,] but can be a synthetic product by chemical precipitation or by electrolytic methods.

The last three sentences above probably seem incredibly long to you and needy of commas at *and* and *but*. Rather than break our rule (and remember it's not breaking the rule that matters; it's creating more and more exceptions that will drive us all crazy), why not split these into two sentences each as in the following?

The observation and measurement of such small frequency shifts require excellent radar frequency-stability characteristics that are not usually found in conventional radar. However, this same observation and measurement can be added without a drastic increase in equipment cost.

Pulse Doppler radar effectively samples the backscattered signal at the radar repetition rate. This type of radar therefore can provide unambiguous Doppler frequency observations only in the frequency range allowed by the sampling rate.

The manganese dioxide used in batteries is usually obtained from natural ore (mainly from Gabon, Greece, and Mexico). It can also be a synthetic product prepared by chemical precipitation or electrolytic methods.

Nonrestrictive Elements

Use commas around all nonrestrictive elements. Nonrestrictive elements are phrases and clauses that are nonessential to the grammar of the sentence. These elements can be taken out of the sentence without hurting its basic message. Use commas around these nonrestrictive elements. Here are some examples:

Eighty percent of the work done by the heart is carried out by the left ventricle, which pumps blood into the arteries serving the organs and the tissues. (Nice of the writer to remind us what the left ventricle does, but the sentence could live without it; it would still make sense.)

The test produced a speed in the high-pressure hydrogen turbopump of 7000 RPM, which is 19 percent of the design speed. (This detail is additional and not essential to the sense of the sentence.)

The Coriolis force, caused by the rotation of the earth, always acts at right angles to the pressure gradient in the northern hemisphere. (This definition is helpful but again is not essential to the sentence.)

The bulky equipment, although placed on a rolling cart, must always remain within six feet of the heart transplant patient. (Nonessential stuff--put commas around it!)

The formation of hurricane, a type of atmospheric vortex, involves the combined effect of pressure and circular wind.

Researchers also found that heavy drinkers--women drinking at least 1.6 ounces of absolute alcohol during pregnancy--have infants averaging 59 grams less than the infants of lighter drinkers. (Nonessential stuff--put commas around it, or in this case dashes, which are commas by another name.)

Adding waterproofing material to a fabric increases the contact angle, making the fabric water-repellent. (Nonessential stuff--put commas around it!)

Molecules may also have some degree of ordering as well as disordered motion, in which case the total energy is the sum of the mechanical and thermal energies. (Nonessential stuff--put commas around it!)

Restrictive Elements

Do not use commas around restrictive elements. Restrictive elements are phrases and clauses that a sentence desperately needs to make sense, to say what it means to say. If you take restrictive elements out of a sentence, you wreck the sentence!

Restrictive Elements

Problem:	You can use the system[,] when the login prompt appears. (The way this sentence is punctuated implies that you can use the system any old time! The comma indicates that the clause beginning with "when" can be lifted from the sentence.)
Revision:	You can use the system when the login prompt appears. (The clause beginning with "when" is restrictive--it can't be omitted from the sentence and therefore should not be punctuated. Now the sentence means that you can use the system only when the prompt appears.)

Here are some additional examples of this rather tricky rule.

A turbopump is essentially a pump that is turned by the action of a turbine that shares a common shaft with the pump. (It's not any old pump; it's the one that does what the latter part of this sentence says it does. Imagine this sentence ending at "essentially a pump.")

Eighty percent of the work done by the heart is carried out by the left ventricle. (Imagine this sentence without "done by the heart," which is the restrictive element in this sentence. No commas here!)

A drop of water almost flattens out when it is placed on a glass plate. (Imagine this sentence without "when it is placed on a glass plate," which is the restrictive element here. No commas need apply!)

In one study, 11 percent of the offspring whose mothers consumed 2 to 4 drinks per day showed partial features of fetal alcohol syndrome (FAS), while 19 percent of those whose mothers consumed 4 or more drinks per day showed FAS features. (Imagine this sentence without "whose mothers consumed 2 to 4 drinks per day" or without "whose mothers consumed 4 or more drinks per day." The sentence simply wouldn't make any sense. No commas!)

Series Elements

Use a comma before the "and" in a series of three or more. In a series of three or more words or phrases, go ahead and put the comma before the *and* that occurs before the final element. You may have heard that this series-*and* comma rule is optional. However, there are situations where the lack of the series-*and* comma (also known as the Oxford comma) can cause confusion. And when you consider that using the Oxford comma *can* hurt the sense of the sentence, it makes sense to use it in all cases. Here are some examples:

Instrument panels, bumper components, door liners, seat covers, and grille panels are the most common parts produced directly by automakers.

A 12-ounce can of beer, a 5-ounce glass of wine, and a mixed drink with 1.5 ounces of 80-proof liquor all contain approximately the same amount of alcohol.

The development years involved designing the components for the Space Shuttle's engines, testing the original designs, and retesting the redesigned components.

In humans, the period of rapid brain development begins at mid-pregnancy, peaks in the third trimester, and ends by the postnatal year.

Two-element Series

Do not use a comma between a series of only two. Be careful not to apply the Oxford comma rule to a series of only two elements. Watch out also for those situations where it looks like you have a series of three elements, but it is actually a series of two noun phrases and a compound verb phrase. See the example:

We brought bread and cheese and read poetry. (Sorry for the Dick-and-Jane sentence, but notice that "bread," "cheese," and "poetry" are not really in a series. No commas for either "and" here.

Series Adjectives

Punctuate series adjectives carefully. It gets tricky knowing how to punctuate when two or more adjectives pile up in front of a noun. One fairly reliable technique is this: if you can switch the order of the adjectives or if you can insert *and* between them without making the phrase sound weird, then you can consider using commas. (Remember that in no case is there a comma between the final series adjective and the noun it modifies.)

He's having his third mid-life crisis. Now he wants a new red sports car. (You couldn't say "mid-life third crisis" nor could you say "sports red new car"--so no commas in or amongst these adjectives.)

Each door is held shut with an adjustable, spring-loaded door latch. (You probably could switch "adjustable" and "spring-loaded"--use a comma here.)

As each rack passes through the wash chamber, the dishes get a thorough soil-stripping wash and a final, automatic hot-water rinse. (You probably could switch "final" and "automatic"--use a comma here.)

These last two examples may have felt a bit "iffy" to you--the technique is only "fairly" reliable.

Colons

Although the colon has other uses in writing, its most important function is to act as a signal to the reader--it says something like "Okay, reader! Here it comes!" In the first example, notice the words before the colon make a complete statement--at least grammatically.

To make a kite, you need the following items: string, paper, thin sticks, glue, and scissors.

The main engines of the Space Shuttle consist of six main components: the external tank, the low-pressure turbopump, the high-pressure turbopumps, the preburners, the combustion chamber, and the nozzle.

Hurricane size is expressed in three ways: the strength of the maximum winds, the diameter of the hurricane-force winds, the diameter of the gale-force winds, and the overall size the cyclone circulation.

To make a metal dashboard, three steps are required: (1) the metal must be stamped; (2) the texture must be stamped into the metal; and (3) the part must be painted.

Notice in the last example that the first sentence introduces a series of complete sentences. You can use the colon to connect two complete sentences--as long as the first sentence introduces or prepares for the second. Here are some examples of this possibility:

The grades of the students in the caffeine research project told a dramatic story: the higher the caffeine intake, the lower the grades, both for semester and overall grade point average.

In general, shelf-life increases as the cell size of the battery becomes smaller: with well-constructed cells, shelf-lives of three years with a No. 6 telephone cell and ten years with a penlight cell are possible.

The line-of-sight in a communication satellite can be a problem: communication satellites can see the earth's surface only between about 83 degrees north latitude and 83 degrees south latitude.

Many of the new applications of microcomputer are "interactive": there is frequent interaction between the computer and one or more users.

However, don't use a colon inside a complete sentence. It should connect only complete sentences to complete sentences or connect complete sentences to lists.

Examples

Problem:	The typical Doppler velocity sensor consists of[:] a transistor, an antenna, and a receiver.
Revision:	The typical Doppler velocity sensor consists of a transistor, an antenna, and a receiver.
Problem:	Three significant types of generating plants are[:] hydroelectric, fossil-fuel-electric, and nuclear-electric.
Revision:	Three significant types of generating plants are hydroelectric, fossil-fuel-electric, and nuclear-electric.
Problem:	You will need[:] string, paper, thin sticks, glue, and scissors, to make a kite.
Revision:	You will need the following items--string, paper, thin sticks, glue, and scissors--to make a kite.

Look at this last example closely: the grammatical core of the sentence is "You will need the following items...to make a kite." You don't want to break up the core grammar of a sentence this way with a colon.

Semicolons

The semicolon could be called a strong comma. Its two main uses are to connect two (or more) sentences that seem very closely related and to clarify the punctuation of a series of items that have their own internal commas.

You may have had some unhappy encounters with run-ons and comma splices in the past. These two "comma faults" usually result from the writer's sense that the sentences involved in the problem are very closely related--the full stop signaled by the period seems like too full of a stop. (It's almost like music; makes you wonder why we don't have the equivalent of whole, half, quarter, and eighth rests in punctuation.) Often, these run-on sentences and comma splices can be fixed by substituting a semicolon for the offending comma.

But not always. Some writers go way overboard in sensing close relations between sentences. Well, yes, every sentence in a document is related to every other--they ought to be! But they need to be reeeaaally closely related. Here are some examples:

"Plaque-fissuring" refers to the formation of an opening from the lumen to the intima; it leads to an intra-intimal thrombus containing not just red cells but mainly firbrin and platelets.

In 1940, philanthropy accounted for 24 per cent of the total operating budget of nonprofit hospitals in New York City; in 1948, it had dropped to 17 per cent.

Gray mold is one of the most important fungal diseases in Italian viticulture; its growth causes serious production losses and adversely affects wine quality.

The other use of the semicolon worth noting here is how it can clarify items in a series that have commas within them already:

Injury caused by pollutants can easily be mistaken for injury caused by other stresses; or, just the opposite, injury symptoms from adverse temperature or moisture relations may resemble, and can be incorrectly attributed to, air pollutants.

Possible research areas announced recently have included genetics, fermentation microbiology, and immobilized biocatalysts; but environment biotechnology, such as metal recovery and waste recycling, is also included.

A typical membrane potential of about one-tenth of a volt sounds relatively small; but, because it occurs across a membrane that is only about 10 nanometers thick, it represents an enormous voltage gradient of about 10 million volts per meter.

The heart undergoes two cardiac cycle periods: diastole, when blood enters the ventricles; and systole, when the ventricles contract and blood is pumped out.

An organization may be functional, with responsibility assigned on the basis of buying, selling, promotion, distribution, and other tasks; production-oriented, with production managers for each product category and brand managers for each individual brand in addition to functional categories; or market-oriented, with managers assigned on the basis of geographical markets and customer types in addition to functional categories.

Electric power substations are used for some or all of the following purposes: connection of generators, transmission or distribution lines, and loads to each other; transformation of power from one voltage level to another; interconnection of alternate sources of power; and detection of faults, monitoring and recording of information, power measurement, and remote communication.

A common misuse of the semicolon is to plunk it down between what appear to be two complete sentences:

Examples

Problem:	The slide rule was important device for scientists and engineers for many years[;] although its use has all but vanished since the advent of the pocket calculator.
Revision:	The slide rule was an important device for scientists and engineers for many years, although its use has all but vanished since the advent of the pocket calculator. <i>(The "although" clause is not complete; it can't stand on its own.)</i>

Apostrophes

Pity the poor apostrophe--it's practically an endangered species. The problem with the apostrophe is that it has some conflicting tasks: it is used primarily to show possession, mark contractions, and, minimally, to show plurals. But people have gotten it all mixed up. For example, the likes of "John love's Mary" was becoming pretty common in telephone booths before the rise of the cell phone. A scant two or three hundred years ago, people didn't even use apostrophes (yes--a world without apostrophes!). But the thing does add precision to writing; it does prevent confusion. The rules are super simple; here they are:

To show possession for singular words not ending in s, add 's

Earth's shadow	the fish's ear
the Moon's orbit	India's population
this company's profits	the family's car

To show possession for singular words ending in s, x, or z; add 's or just an '

Venus's (or Venus') orbit	Mars's (or Mars') shadow	the box's (or box') flap
James's (or James') calculator	tennis's (or tennis') popularity	the fez's (or fez') tassel

To show possession for plural words ending in s, add ' to the plural form of the word (but don't add another s)

these companies' employees	planets' orbits
these species' niches	these countries' populations
southern states' capitals	these computers' capabilities

To show possession for plural words not ending in s, add 's

women's rights	men's rights
children's education	geese's honking

To show the plural of numbers or letters when they are discussed as such, add 's (again usage varies on this, but this is a safe choice)

Do you know how many c's and s's are in the word ne-e-ry?
On a computer, O's are represented by O's and 0's with 0's.
His speech was filled with annoying uh's, okay's, and you know's.

To show possession for possessive pronouns, don't use the apostrophe (don't ask me why)

This book is yours.
This CRT is theirs, not ours.

And, now, everybody's personal favorite—the one that English teachers and copyeditors can spot from outer space—the rules for its and it's. Its is the possessive form of it; it's is the contraction for it is (exactly opposite, I realize)

The SGO density gauge is missing one of its adjusting knobs. <i>(possessive here)</i>
It's unfortunate that our language has so many exceptions to its rules—or is it? <i>(contraction for "it is" here)</i>

Now, there are others rules involving apostrophes such as for contractions or for quotes within quotes, but we'll leave those for the reference books to handle.

Hyphens

Someone once said, "Take hyphens seriously, and you will surely go mad." They weren't lying!

Hyphens are supposed to keep us from misreading things and show us how words in complex phrases relate to each other. The problem is that the rules for hyphens just cannot be applied absolutely consistently—you end up hyphenating everything including the kitchen sink. Professional editors end up keeping long lists of exactly which word pairs they will hyphenate in a specific document (so that they don't end up in therapy).

Hyphens do matter, however (save the hyphen!). Our language culture seems to be very "into" piling up ambitious noun phrases. These sentences verge on having a problem called "noun stacks." To read this kind of stuff, we need hyphens—they show us what goes with what. Hyphens show that a pair of words is acting as a unit and must be read that way. The common types of unit modifiers—which are two or more words acting as a unit—are discussed in the following (but it's by no means exhaustive):

Although styles vary on this, do not hyphenate the common prefixes such as pre, anti, multi, and so on (unless it spells some other word or just looks hopelessly weird). However, do hyphenate prefix words such as self-

self-lubricating hinges	nonprescription drugs
multistep reaction	precooked foods
antibotulism agent	mid-1970s
nonmalarial areas	micro-universe
reusable	subnuclear
re-sent	anti-icing

Hyphenate a unit modifier ("5-year" in the first example) made up of a number followed by a unit of measurement

5-year grant	10-month period
20-megabyte memory	3.5-inch diskette
8-oz. cup	4-gallon tub

Hyphenate an elliptical form of a longer phrase that is acting as a unit modifier

below-average rainfall	warm-up period
built-in scale	on-board timer
start-up costs	pay-off period
in-service accuracy	written-out number
immune-deficient animals	

Hyphenate a non-verb element and a verb-like element acting as a unit

drought-producing system	water-repellent fabric
coffee-flavored ice cream	nutrient-rich waters
government-sponsored programs	corrosion-resistant metal
pressure-induced melting	water-soluble reactants
spring-balanced doors	salt-free diet
health-related costs	caffeine-containing substances

Watch out for three or more words acting as a unit to modify a following noun

case-by-case basis	a three-to-one ratio
the right-to-die statutes	the air-to-ground voice transmission
on-the-job experience	

Don't hyphenate units in which the first word ends in -ly

highly developed country	fully equipped computer
--------------------------	-------------------------

The toughest area for hyphenation are those combinations that look like *adjective + noun + noun* or like *noun + noun + noun*. (True, only the last noun is *really* a noun, but let's not worry about that.) If the initial adjective or noun modifies the final (and real) noun, do *not* use a hyphen. If the initial adjective or noun modifies the noun directly following it, consider using a hyphen.

These examples do not need a hyphen

embryonic stem cells	poor economic performance
high process yields	

These examples could use hyphens according to some styles

cell-replacement strategies	cell-surface markers
big-name automakers	large-scale production

If you are in doubt about whether to use a hyphen, don't use it. The best resource on hyphens is *Garner's Modern American Usage*; "Phrasal adjectives."

Once you get a partial feel for hyphens, watch out! You might start acting like Lucy in that show where she has been on the assembly line too long and starts going after everything and everybody with her wrenches. Everything will seem like it needs a hyphen! When that happens, back off, and ask yourself—could someone misread this sentence without a hyphen, even if they were just being mean? If it positively cannot be misread, then give your hyphen key a break.

Comma Splices and Run-ons

The comma-splice and run-on sentence (and the fused sentence, as a variant is called) are all examples of the problem in which two or more sentences are improperly joined. In the typical *comma-splice* sentence, two sentences are joined by a comma without an intervening coordinating conjunction (*and*, *or*, *nor*, *but*, *yet*). Technically, the *run-on* sentence is a sentence that goes on and on and needs to be broken up; it's likely to be a comma splice as well. A *fused* sentence is two complete sentences just jammed together without any punctuation and without any conjunction.

We write comma-splice and run-on sentences because we sense that the sentences involved are closely related—a full-stop period just doesn't seem right. Actually, the semicolon *is* the right choice in these situations (although it's easy to go semicolon crazy when you first start using them). Here are some examples of this type of problem and their revisions:

Examples

Problem:	Sometimes, books do not have the most complete information, it is a good idea then to look for articles in specialized periodicals.
Revision:	Sometimes, books do not have the most complete information; it is a good idea then to look for articles in specialized periodicals.
Problem:	Most of the hours I've earned toward my associate's degree do not transfer, however, I do have at least some hours the University will accept.
Revision:	Most of the hours I've earned toward my associate's degree do not transfer. However, I do have at least some hours the University will accept.
Problem:	The opposite is true of stronger types of stainless steel, they tend to be more susceptible to rust.
Revision:	The opposite is true of stronger types of stainless steel: they tend to be more susceptible to rust.
Problem:	Some people were highly educated professionals, others were from small villages in underdeveloped countries.
Revision:	Some people were highly educated professionals, while others were from small villages in underdeveloped countries.
Problem:	This report presents the data we found concerning the cost of the water treatment project, then it presents comparative data from other similar projects.
Revision:	This report first presents the data we found concerning the cost of the water treatment project and then comparative data from other similar projects.
Problem:	Most of this firm's contracts have been with major metropolitan hospitals, included among them is Memorial East in Luckenbach.
Revision:	Most of this firm's contracts have been with major metropolitan hospitals, included among which is Memorial East in Luckenbach.

Fragments

Fragments are simply incomplete sentences—grammatically incomplete. They usually come about because the sentence may already seem too long. Also, in conversation, we typically speak in fragments. Here are some examples and their revisions:

Examples

Problem:	Mary appeared at the committee meeting last week. And made a convincing presentation of her ideas about the new product.
Revision:	Mary appeared at the committee meeting last week and made a convincing presentation of her ideas about the new product.
Problem:	The committee considered her ideas for a new marketing strategy quite powerful. The best ideas that they had heard in years.
Revision:	The committee considered her ideas for a new marketing strategy quite powerful, the best ideas that they had heard in years.
Problem:	In a proposal, you must include a number of sections. For example, a discussion of your personnel and their qualifications, your expectations concerning the schedule of the project, and a cost breakdown.
Revision:	In a proposal, you must include a number of sections: for example, a discussion of your personnel and their qualifications, your expectations concerning the schedule of the project, and a cost breakdown.
Problem:	The research team has completely reorganized the workload. Making sure that members work in areas of their own expertise and that no member is assigned proportionately too much work.
Revision:	The research team has completely reorganized the workload. They made sure that members work in areas of their own expertise and that no member is assigned proportionately too much work.
Problem:	She spent a full month evaluating his computer-based instructional materials. Which she eventually sent to her supervisor with the strongest of recommendations.
Revision:	She spent a full month evaluating his computer-based instructional materials. Eventually, she sent the evaluation to her supervisor with the strongest of recommendations.
Problem:	The corporation wants to begin a new marketing push in educational software. Although the more conservative executives of the firm are skeptical.
Revision:	Although the more conservative executives of the firm are skeptical, the corporation wants to begin a new

marketing push in educational software.

Problem modifiers

Modifier problems occur when the word or phrase that a modifier is supposed to modify is unclear or absent, or when the modifier is located in the wrong place within the sentence. A modifier is any element—a word, phrase, or clause—that adds information to a noun or pronoun in a sentence. Modifier problems are usually divided into two groups: misplaced modifiers and dangling modifiers:

Examples

Misplaced modifiers	<p>They found out that the walkways had collapsed on the late evening news. (<i>Was that before or after sports?</i>)</p> <p>The committee nearly spent a hundred hours investigating the accident. (<i>Did they spend even a minute?</i>)</p> <p>The supervisor said after the initial planning the in-depth study would begin. (<i>Just when did she say that, and when will the study begin?</i>)</p>
Dangling modifiers	<p>Having damaged the previous one, a new fuse was installed in the car. (<i>Who damaged that fuse?</i>)</p> <p>After receiving the new dumb waiter, household chores became so much easier in the old mansion. (<i>Who received the dumb waiter?</i>)</p> <p>Using a grant from the Urban Mass Transportation Administration, a contraflow lane was designed for I-45 North. (<i>Who used that money?</i>)</p> <p>Pointing out the productivity and health problems plaguing US workers, aerobic fitness programs may become much more common in American industry, according to the spokeswoman. (<i>Who pointed that out?</i>)</p>

To correct misplaced modifier problems, you can usually relocate the misplaced modifier (the word or phrase). To correct dangling modifiers, you can rephrase the dangling modifier, or rephrase the rest of the sentence that it modifies.

Examples

Revisions	<p>On the late evening news, we heard that the walkways had collapsed.</p> <p>The committee spent nearly a hundred hours investigating the accident.</p> <p>The supervisor said that the in-depth study would begin after the initial planning.</p>
	<p>Because the previous fuse had been damaged, a new one had to be installed.</p> <p>or</p> <p>Having damaged the previous one, I had to install a new fuse in my car.</p>
	<p>After we received the dumb waiter, it was immediately installed.</p> <p>or</p> <p>After receiving the dumb waiter, we immediately installed it.</p>
	<p>When the Urban Mass Transportation Administration granted funds to the city, planners began designing a contraflow lane for I-45 North.</p>

	<p>or</p> <p>Using a grant from the Urban Mass Transportation Administration, city planners designed a contraflow lane for I-45 North.</p>
	<p>Because of the productivity and health problems plaguing US workers, aerobic fitness programs may become much more common in American industry, according to the spokeswoman.</p>
	<p>or</p> <p>Pointing out the productivity and health problems plaguing US workers, the spokeswoman said that aerobic fitness programs may become much more common in American industry.</p>

One particularly effective way to correct dangling modifiers is to create a summary appositive, that is, a noun or pronoun summarizing what was just said followed by an adjective clause:

Examples

<i>Dangling modifier problems</i>	<i>Summary appositive revisions</i>
Stars that were formed relatively recently should have higher concentrations of heavy elements than do the older stars, which is confirmed by observation.	Stars that were formed relatively recently should have higher concentrations of heavy elements than do the older stars, a prediction that is confirmed by observation.
Most astronomers now believe that the energy of quasars comes from giant black holes in the cores of the quasars, which fits the growing belief that black holes are present in the cores of many galaxies, our own included.	Most astronomers now believe that the energy of quasars comes from giant black holes in the holes of quasars, a theory that fits the growing belief that black holes are present in the cores of many galaxies, our own included.

Parallelism

Parallelism refers to the way that items in a series are worded. You want to use the same style of wording in a series of items—it makes it easier on the reader. Widely varied wording is distracting and potentially confusing to readers. Here are some examples, with revisions and some comments:

Examples

Problem	The report discusses how telescopes work, what types are available, mounts, accessories, and techniques for beginning star gazers. <i>(The "how" and the "why" clauses are not parallel to the "mounts," "accessories," and "techniques" phrases.)</i>
Revision	The report discusses how telescopes work; what types of telescopes, mounts, and accessories are available; and how to begin your hobby as a star gazer.
Problem	Customers often call the showroom to inquire about pricing, what items are available, and to place orders . <i>(The "what items are available" clause does not go with the two phrases beginning with "to.")</i>
Revision	Customers often call the showroom to inquire about prices, check on the availability of certain items, and place orders.
Problem	While the dialysis solution remains in the peritoneal cavity, the dialysis is achieved, a process that includes the removal of nitrogenous wastes and correcting electrolyte imbalances and fluid overloads . <i>(The "removal" phrase and the "correcting" phrase are not parallel to each other.)</i>
Revision	While the dialysis solution remains in the peritoneal cavity, the dialysis is achieved, a process that includes the removal of nitrogenous wastes and the correction of electrolyte imbalances and fluid overloads.

Problem	This report is intended for people with some electronics background but <u>have little or no knowledge of geophysical prospecting</u> . (The "with" phrase is not parallel with the "have little" clause—this one is not even grammatical.)
Revision	This report is intended for people with some electronics background but with little or no knowledge of geophysical prospecting.

Parallelism problems have to do when same types of phrasing are not used in the same areas of a document: such as for list items in a vertical list, or for all headings at a certain level within a specific part of a document. At times, working on parallelism of phrasing is pedantic and unnecessary. However, in many instances, parallel phrasing can give readers important cues about how to interpret information. A jumble of dissimilar styles of phrasing for similar elements can be confusing. Shown below are those different styles:

Styles of Phrasing

Questions	Noun Phrasing
How are groundwater samples collected? How should soil samples be handled? Must monitor wells be used to collect groundwater for laboratory analysis? What should the samples be analyzed for?	Method of groundwater sample collection Soil sample handling Purpose of monitor wells in groundwater collection for laboratory analysis Purpose of soil sample analysis
Gerund Phrasing	Sentences
Collecting groundwater samples Handling soil samples Using monitor wells in groundwater collection for laboratory analysis Analyzing samples	Groundwater samples must be collected properly. Soil samples must be handled using the specified method. Monitor wells must be used to collect groundwater for laboratory analysis. Samples must be analyzed for specific elements.
Infinitives	Imperatives
To collect groundwater samples To handle soil samples To use monitor wells in groundwater collection for laboratory analysis To analyze samples	Collect groundwater samples. Handle soil samples properly. Use monitor wells in groundwater collection for laboratory analysis. Analyze samples.

Subject-verb agreement

With subject-verb agreement problems, either a singular subject is matched with a plural verb, or vice versa. (Remember that some singular verbs end in -s.) Sometimes it's hard to spot the true subject, particularly in these cases:

When several words come between the subject and verb

Agreement problems	Revisions
The communications between the programmer and the rest of the company <u>tends</u> to be rather informal.	The communications between the programmer and the rest of the company <u>tend</u> to be rather informal.
The purpose of the monorails <u>have</u> changed from one of carrying food to one of carrying people to work in crowded urban areas.	The purpose of the monorails <u>has</u> changed from one of carrying food to one of carrying people to work in crowded urban areas.
The shortage of available infants and the availability of children with special needs <u>has</u> changed the focus of adoption for many parents.	The shortage of available infants and the availability of children with special needs <u>have</u> changed the focus of adoption for many parents.

When there are two or more subjects joined by and or or

Agreement problems	Revisions
In the computer's memory <u>is</u> stored the program and the data to be manipulated by that program.	In the computer's memory <u>are</u> stored the program and the data to be manipulated by that program.
Either BASIC or Pascal <u>are</u> the high-level computer	Either BASIC or Pascal <u>is</u> the high-level computer

language you should take first.	language you should take first.
Skyrocketing charges for data preparation, the need to keep pace with rapidly increasing amounts of data, and requirements for fast system response <u>has</u> led to a search for more efficient input devices.	Skyrocketing charges for data preparation, the need to keep pace with rapidly increasing amounts of data, and requirements for fast system response have led to a search for more efficient input devices.
The magnetic-ink character-recognition device and the optical character-recognition device <u>is</u> two important advances in the preparation of batch input.	The magnetic-ink character-recognition device and the optical character-recognition device are two important advances in the preparation of batch input.

When the normal subject-verb order is inverted

Agreement problems	Revisions
In the computer's memory <u>is</u> stored the program and the data to be manipulated by that program.	In the computer's memory are stored the program and the data to be manipulated by that program.
Introduced in 1968 by the Computer Machine Corporation <u>was</u> the concept of key-to-disk processing and the concept of shared processing.	Introduced in 1968 by the Computer Machine Corporation were the concept of key-to-disk processing and the concept of shared processing.
Equivalent to more than 3000 punched cards <u>are</u> the single diskette , first introduced in 1972.	Equivalent to more than 3000 punched cards is the single diskette, first introduced in 1972.
Through the center of the core <u>runs</u> several sense wires .	Through the center of the core run several sense wires.

When the subject is a word like each, every, none, either, neither, no one, and nobody, especially when followed by a plural object of a preposition

Agreement problems	Revisions
Each of the steps in the process <u>are</u> treated in a separate chapter of this report.	Each of the steps in the process is treated in a separate chapter of this report.
Neither of the two high-level languages <u>offer</u> a facility for designing your own variables.	Neither of the two high-level languages offers a facility for designing your own variables.

When the subject is a phrase or clause acting as a unit

Agreement problems	Revisions
Printing 54,000 chars. per 60 seconds <u>were</u> considered a high speed for printers at one time.	Printing 54,000 chars. per 60 seconds was considered a high speed for printers at one time.
Reversing the direction of currents through the wires <u>change</u> the magnetic state of the core.	Reversing the direction of currents through the wires changes the magnetic state of the core.
What is truly amazing about bits cells in integrated circuits <u>are</u> that 30 cells lined up side by side are about as wide as a human hair.	What is truly amazing about bits cells in integrated circuits is that 30 cells lined up side by side are about as wide as a human hair.

Pronoun reference

Pronoun reference is an area that has caused international conflict and created major rifts in the women's movement—so don't expect this little section to explain it all. A pronoun, as you may know, is a word like "he," "they," "him," "them," "which," "this," "everyone," "each," and so on. It's like a variable in programming—it points to some other word that holds its meaning.

Problems arise when you can't figure out what the pronoun is pointing to (its "reference") and when it doesn't "agree" in number or gender with what it is pointing to. You may have experienced the first type of problem: you're reading along in some incredibly technical thing, and it up and refers to something as "this." You look back up at the sea of words you have just been laboriously reading through—you say "this what?!" You have just experienced one form of the pronoun-reference problem.

Example

Agreement problems	Revisions
Lasers have also been used to study the reaction by which nitric oxide and ozone make nitrogen dioxide (NO ₂) and molecular oxygen. It plays an important role in the chemistry of the ozone layer that surrounds the earth and protects us from the sun's harmful ultraviolet radiation. ("It" what?)	Lasers have also been used to study the reaction by which nitric oxide and ozone make nitrogen dioxide (NO ₂) and molecular oxygen. This process plays an important role in the chemistry of the ozone layer that surrounds the earth and protects us from the sun's harmful ultraviolet radiation. (Okay, now we see...)

The second kind of pronoun-reference problem arises over lack of agreement between the pronoun and what it refers to.

Example

Problem:	Motorola has just announced <u>their</u> new PowerPC chip.
Revision:	Motorola has just announced its new PowerPC chip.

The problem here is that "Motorola" is a singular thing, while "their" is a plural thing—they don't agree in number! Now, maybe anyone knows what's being said here, but this writing is imprecise, and it can lead to serious problems, given the right situation.

Example

Problem:	These days, every student needs to own <u>their</u> own computer.
Revision 1:	Revision 1: These days, students need to own their own computers.
Revision 2:	These days, every student needs to own his or her own computer.
Revision 3:	These days, every student needs to own a computer.

The problem in this example is that "student" does not agree with "their": one is singular; the other, plural. Some call this usage acceptable (*Merriam-Webster*). However, it is imprecise—and we care greatly about precision in technical writing. We have to search for the plural noun we think is being referred to by "their." Not a good idea in technical writing. As you can see from the revisions, there sometimes is no good way to fix the problem. Whenever it works, try converting the singular noun to a plural—the plural pronoun will then be okay (but don't forget to change the verb to plural). Here are some additional examples:

Examples

Problem	Revision
NASA hoped that, by using production tooling rather than by making each tool individually, <u>they</u> could save time and money.	NASA hoped that, by using production tooling rather than by making each tool individually, it could save time and money.
If an energy efficient system can be developed, electrical vehicles could become as popular as <u>its</u> conventional counterpart.	If an energy-efficient system can be developed, electrical vehicles could become as popular as their conventional counterpart.
Currently, Houston has \$328.2 million in <u>their</u> 1984-1985 budget to help fund a new form of mass transportation.	Currently, Houston has \$328.2 million in its 1984-1985 budget to help fund a new form of mass transportation.
Aerobic fitness programs help to improve an employee's physical condition by strengthening <u>their</u> circulatory, muscular, and respiratory systems.	Aerobic fitness programs help to improve employees' physical condition by strengthening their circulatory, muscular, and respiratory systems.
American industry should implement aerobic fitness programs for the betterment of <u>their</u> employees even if there is some opposition	American industry should implement aerobic fitness programs for the betterment of its

to it at first. (A double dose of pronoun-reference grief! *It* refers to *what*?)

employees even if there is some opposition to such **programs** at first.

Pronoun case (who, whom)

Yes, you too can learn the proper usage of *who* and *whom*. *Who* is used in the same slots that words like *he*, *she*, *they*, and *we* are used; *whom* is used in the same slots that *him*, *her*, *them*, and *us* are used. So if you can run a little replacement test, you can figure out which to use.

Replacement Test

1	<p>Imagine that you start out with sentences like these (admittedly not an eloquent crew but they'll do):</p> <p>It was the NBS engineers [who, whom?] Sen. Eagleton's office contacted on July 17.</p> <p>It was the NBS engineers [who, whom?] performed the tests on the walkways.</p> <p>Send a copy of the report to [whoever, whomever?] wants one.</p> <p>No one is sure [who, whom?] will be the next mayor.</p> <p>It was the NBS engineers to [who, whom?] Sen. Eagleton's office made the request for technical assistance.</p>
2	<p>Now, strike out all the words up to the <i>who</i> or <i>whom</i> including prepositions:</p> <p>It was the NBS engineers [who, whom?] Sen. Eagleton's office contacted on July 17.</p> <p>It was the NBS engineers [who, whom?] performed the tests on the walkways.</p> <p>Send a copy of the report to [whoever, whomever?] wants one.</p> <p>No one is sure [who, whom?] will be the next mayor.</p> <p>It was the NBS engineers to [who, whom?] Sen. Eagleton's office made the request for technical assistance.</p>
3	<p>Next, juggle the remaining words so that they make a complete sentence:</p> <p>Sen. Eagleton's office contacted the NBS engineers.</p> <p>The NBS engineers performed the tests on the walkways.</p> <p>[Who, whom] wants one?</p> <p>[Who, whom] will be the next mayor?</p> <p>Sen. Eagleton's office made the request for the technical assistance to the NBS engineers.</p>
4	<p>If it sounds right to substitute <i>I</i>, <i>he</i>, <i>she</i>, <i>they</i>, <i>we</i>, use <i>who</i>. If it sounds right to substitute <i>me</i>, <i>him</i>, <i>her</i>, <i>us</i>, <i>them</i>, use <i>whom</i>:</p> <p>Sen. Eagleton's office contacted <i>them</i>. => (whom)</p> <p><i>They</i> performed the tests on the walkways. => (who)</p> <p><i>He</i> wants one? => (who)</p> <p><i>She</i> will be the next mayor? => (who)</p> <p>Sen. Eagleton's office made the request for the technical assistance to <i>them</i>. => (whom)</p>
5	<p>Here are the results:</p>

It was the NBS engineers whom Sen. Eagleton's office contacted on July 17.

It was the NBS engineers who performed the tests on the walkways.

Send a copy of the report to whoever wants one.

No one is sure who will be the next mayor.

It was the NBS engineers to whom Sen. Eagleton's office made the request for technical assistance.

This trick works without having to toss around terms like *nominative case* and *objective case*. (Incidentally, the third example, which contains "whoever wants one," is typically missed by people who pride themselves on their grammar. The rule about always using *whom* when it comes after a preposition does *not* work!)

Caution: You can get *whom* exactly grammatically right but sound fussy and pedantic. The famous day-time quiz show in which Johnny Carson got his start was called *Who Do you Trust?* not *Whom Do you Trust?*. You have to have an ear for the language. If it sounds fussy and pedantic to use *whom*, use *who*.

Capitalization

One of the big problems in technical writing involves capitalization. Technical people, developers, and other nonprofessional writers tend to use capital letters for everything that feels important—particularly the stuff that they've worked on. Problem is that this practice breaks all our standard capitalization rules and, more importantly, makes text harder to read. Most professionals in publishing, writing, and editing believe that excessive and unnecessary capitalization is distracting and confusing for readers. Capitalization should *not* be used for emphasis (use underscores or italics for that, or for really important things, use special notices).

Capital letters should be used for proper names—formal, official names of things and people. For example, Tandem Corporation is a proper name; Mosaic is the proper name of a software product. However, a loose reference to the "development area" at IBM does not need caps; it's not the official name of that area. Similarly, WordPerfect is a proper name, but not its grammar-checking feature. In technical writing, the impulse is often to use caps for the components of a thing—no! For example, if we were discussing the disk drive, the monitor, the CPU unit, the modem, the mouse, or the printer of a computing system, none of it should be capitalized. However, if we were talking about the the Dell NL40 Notebook computer, the Microsoft Mouse, or the IBM 6091 Display, then certainly caps are in order.

Of course, there are some exceptions. For example, in instructions, you want to reproduce the capitalization style shown on buttons, knobs, and other physical features of products as well as on the display screens of computer programs as they are shown on the hardware—but not if all caps are used. If I have a Service button on my computer, I'd write it as Service but not SERVICE, no matter how it is shown on the machine.

A common misuse of capitalization involves acronyms. You know that whenever you use an acronym in your text, you should spell it out first then show its acronym in parentheses. Writers often want to put the spelled-out version in initial caps; you would do so only if the spelled-out version were a proper name in its own right:

Examples

The North Atlantic Treaty Organization (NATO) was formed just after World War II.

When you turn your computer on, it normally goes through a process called initial program load (IPL).

Standard rules for caps

Use capital letters for names of people, races, cities, regions, counties, states, nations, languages, and other such proper names

The Early Bird satellite was launched by Intelst, a consortium of Western countries including the United States, France, the United Kingdom, and Germany.

Samuel Morse invented the coding system called the Morse code.

Among Muslims, Ramadan commemorates the first revelation of the Koran and is celebrated by fasting.

The population of Quebec is largely French speaking.

The Middle East, culturally speaking, refers to those lands in that part of the world that are predominantly Islamic in culture.

The Midwest includes Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Kansas, and Nebraska.

In her sophomore semester Gilda took English, French, astronomy, biology, geology and a special course called "Key Concepts in Western Science."

Use capital letters for points of the compass only when they refer to well-established regions, but not when they simply refer to a direction of travel

In the 1970s and 1980s, the major population and economic growth regions of the United States have been the South and Southwest.

The dam is located to the west of the city.

Oil imports from South America have been decreasing recently.

Drive ten miles north from Baldwin City, Kansas, and you'll be in Lawrence.

Use capital letters for titles of offices when the title precedes the name of an officeholder but not when the title occurs alone. This rule is often ignored within organizations that need to use capitalize titles of positions. Another exception to this rule involves the president of the U.S.; some styles require this title to use a capital letter, even when it occurs alone

The first electronic computer was assembled in the years 1940 to 1942 by Professor John V. Atanasoff and Clifford Berry, a student, at Iowa State University.

A professor and a student assembled the world's first electronic computer in the years between the wars.

In the U.S., the president holds the power of veto over any legislation passed by the Congress.

Last week, mayors from several cities in the region met to discuss an integrated system of health care.

Use capital letters for academic subjects only when they are part of a specific course title or when they are derived from the name of a person, country, or language. (This capitalization rule often get bent a little in resumes and application letters. Typically, names of occupations and fields, and job titles get initial caps. By standard capitalization rules, that's not correct, but the usage is so strong in these two types of documents that it has become acceptable)

She took a course in world history called "The Shaping of Western Thought" at Baker University in Kansas.

They consider Chemistry 301 a difficult course even though they are all chemistry majors.

This semester Majorie plans to take French, finance, and physics.

Use capital letters for the days of the week, months, special days, and holidays—but not for the names of the seasons

On Monday, July 24, 1978, they celebrated her birthday at a local restaurant.

Last fall they spent Thanksgiving in Denmark.

In the United States, the national independence day is July the Fourth; in Mexico, it's called *Cinco de Mayo*.

Use capital letters for religions, religious groups, historical events, periods of history, and historical documents

The telegraph played an important role in the Civil War.

The term *Protestantism* is used to distinguish this faith from the other major Christian faiths: Roman Catholicism and Eastern Orthodoxy.

At the Casablanca Conference, the Allies agreed to continue the war until the unconditional surrender of the Axis powers.

The Allies landed on Normandy Beach on July 6, 1944, a day known as D-Day.

The Great Depression in the United States was supposedly precipitated by the stock-market crash of 1929.

Under compulsion by English barons and the church, King John signed the Magna Carta in 1215.

Use capital letters for organization names (commercial, governmental, and non-profit) as well as their products and services

In the late 1950s, the U.S. Department of Defense initiated a number of projects, such as Project Courier, which finally resulted in the Initial Defense Communications Satellite Program (IDCSP).

The IDCSP satellites were launched by the U.S. Air Force in 1966.

Saudi Arabia has its own air force and its own integrated defense system.

After the FCC's 1971 adoption of a "limited skies" policy, three domestic carriers initiated operations during 1974: American Satellite Corporation, a subsidiary of Fairchild industries, Inc.; Americom of RCA; and Western Union.

On March 24, 1980, Pennsylvania Governor Richard Thornburgh asked the Union of Concerned Scientists to make an independent evaluation of the krypton problem at the Three Mile Island nuclear power plant.

Recently, Apple Corporation introduced its Macintosh to compete with IBM's Personal Computer.

Use capital letters for references to most numbered or lettered items (figures, tables, chapters, parts, volumes, rooms, buildings, etc.)

In Figure 3 a simple telegraph arrangement is shown. Unfortunately, this small amount of krypton is uniformly mixed with the roughly 2 million cubic feet of air in the sealed Three Mile Island Unit 2 reactor containment building.

In this book, Chapter 6 discusses how to convert instructions written by engineers into instructions that can be read and understood by ordinary nonspecialists.

In Part I of this book, the basic patterns of technical writing are compared to those of traditional English composition.

Use capital letters for objects that have individualized names

The first operational communications satellite, Early Bird, was launched in 1965.

Until the Challenger space shuttle, expendable launch vehicles such as the Thor Delta, Alpha-Centaur, and Titan were used for launching space communications satellites.

The Golden Gate Bridge was opened in 1937, and it is one of the most extraordinary bridges in the world.

Dr. Smith has her offices in the Woods Building.

Use capital letters for the earth, sun, moon, and universe when they are discussed with other celestial bodies or systems

The Sun is 1.4 km from Earth.

The theory that the Universe is constantly expanding is based on the observation of red-shifts.

Use capital letters for most acronyms, although a few such as ac and dc are not. When in doubt, check your dictionary. Use capital letters for the spelled-out version of acronyms only if the spelled-out versions are proper nouns in their own right

In 1969, an experiment at the Stanford Linear Accelerator (SLAC) shattered protons with electrons.

In 1977 and 1978, NASA launched the first two High-Energy Astronomy Observation (HEAO) satellites to study black holes.

The "brain" of the computer is the central processing unit (CPU).

Numbers vs Words

In the section on hyphens, it was pointed out that worrying too much about hyphens will drive you crazy—so will numbers. The main hurdle to overcome is to learn that in technical contexts, we use numerals in text—even ones below 10—if they are critical values. In other words, we break the rules that are taught in regular writing courses and that are used in normal publishing and copyediting practice. That's because in the technical and scientific context, we are vitally interested in numbers, statistical data, even if it's a 2 or 5 or—yes—even a 0.

The difficulty is in defining the rules. You should use numerals, not words, when the number is a key value, an exact measurement value, or both. For example, in the sentence "Our computer backup system uses 4 mm tape" the numeral is in order. Also in "This recipe calls for 4 cups of unbleached flour." But consider this one: "There are four key elements that define a desktop publishing system." A word, not a numeral, is preferable here because—well, how to explain it? The number of elements is exact all right, but it's just no big deal. Four, five—who cares?

To summarize the rules that we normally apply:

- Don't start sentences with numerals—write the number out or, better yet, rephrase the sentence so that it doesn't begin the sentence.
- For decimal values less than 1, add a 0 before the decimal point: for example, .08 should be 0.08.
- Make a firm decision on how to handle 0 and 1 when they refer to key, exact values and stick with it. (Style varies wildly in technical writing on these two villains.) Some technical styles choose to use words for these; they resign themselves to the slight inconsistency but better readability.
- Use numerals for important, exact values, even when those values are below 10.
- Use words for numerical values that are unimportant, such as in the sentence "There are six data types in the C programming language."
- When you must use fractions, avoid the symbols that may be available in the character set used by your software. Construct the fraction like this: 5-1/4. Be sure and put the hyphen between the whole number and the fraction.
- It would be nice if all fractions could be reset as decimals, but such is not the case when you have things like 1/8 floating around. Stay consistent with either decimals or fractions in these situations.
- Don't make numerical values look more exact than they are. For example, don't add ".00" to a dollar amount if the amount is rounded or estimated.
- For large amounts, you can write things like 36 million or 45 billion, but, for some reason, *not* 23 thousand.
- Apply these rules in specifically technical, scientific contexts only. Be sensitive to what the standard practices are in the context in which you are writing.

Examples

Some 19 million tons of sulphur dioxide are discharged from US sources alone each year, and another 14 million tons from Canada. (Using the number "19" and the word "million" indicates an approximate amount. "19,000,000" might make some readers think it was an exact amount.)

It was not until after December 1952, when 4000 people died in London from air pollution in just a few days, that real gains in pollution-control legislation were made.

The US Army's standard airborne Doppler navigator weighs 28 lb (12.7 kg), requires 89 W of power, and operates at 13.325-GHz frequency.

All vitrain of the European classification, if more than 14 micrometers thick, has been regarded as anthraxylon.

In 1971, 11 countries accounted for about 91 percent of world production of coal.

The Department of the Interior has just published a report that reviews 65 different coal gasification processes.

Combustion turbines total about 8% of the total installed capability of US utility systems and supply less than 3% of the total energy generated.

Internal combustion engines in small power plants account for about 1% of the total power-system generating capability of the US.

The water-cement ratio will generally range from 4 gal of water per sack of cement to about 9 gal per sack. (These are exact values here; in technical writing, use the numeral even if it is below 10.)

The problem is located in piston number 6. (When there are enumerated items or parts, technical writing uses the number, as in this example. But notice that no "#" or "No." is used.)

The signal occurs in 6-second intervals.

The order is for 6-, 8-, and 12-foot two-by-fours.

Use Code 3 if a system shutdown occurs.

Mined coals commonly contain between 5 and 15 percent mineral matter.

The above illustration shows a 20-unit coaxial cable with 9 working coaxial pairs and 2 standby coaxials, which automatically switch in if the electronics of the regular circuits fail.

There are 59 different species of the coffee shrub, but only 4 are of commercial importance.

Most grinds of coffee contain particles ranging in size from 0.023 to 0.055 inches in diameter.

Using carrier frequencies between 0.535 MHz and 1.605 MHz in the US, AM broadcasting stations sprang up all over the country beginning in the 1910s.

As a base from which to work, 2-1/2 to 3 gal of water are needed for each sack of cement for complete hydration and maximum strength. (These are exact values; therefore, in the technical-writing context, we use numerals. Notice how fractional values are handled: put a hyphen between the whole number and the fraction to prevent misreading.)

The order for twelve 30-foot beams was placed yesterday.

The order was for 30 fifteen-gallon tubs.

They used six 8-pound sacks of nails.

The microprocessors of the 70s and 80s operated under the control of clocks running at 1 to 5 MHz, that is, 1 to 5 million counts per second.

Your eye has a bandwidth of 370 trillion Hz, the visible spectrum.

Transmission rates on ETHERNET range from 1 to 10 megabits per second (0.125 to 1.25 million bytes per second).

In 1978, the satellite carriers' revenues were about \$88 million, and by 1986, they are expected to reach \$800 million.

Most communications satellites are in geostationary orbit: at an altitude of 22,300 miles over the surface of the earth and at a distance of 26,260 miles from the center of the earth (the earth's radius being 3960 miles).

Aggregates constitute about 70 percent of a concrete mix.

Uniform compaction of 95% or better of standard AASHTO densities is recommended.

In this book, Chapter 7 discusses the different audiences of technical prose and translation techniques for communicating effectively with the less specialized ones.

The wheels of the four-wheel tractor give it increased speed over the Crawler, but because of the weight distribution over four wheels rather than over two wheels or tracks, this vehicle has less traction.

Hundreds of thousands of people will have purchased microcomputers by the end of 1980. Tens of millions of them will bought them by the end of the century.

There are two telephones in service today for every three people in the US.

In 1965, Dr. Gordon Moore announced his "law" that the complexity of a chip would double every year for ten years. (Use the word "ten" here because it is not an exact amount.)

The typical stand-alone microcomputer system consists of seven physical components. (Use the word "seven" here because, even though it seems like an exact amount, it is not a key value. It doesn't have the same significance as the "7" would have in "7 quarts of oil.")

If you are using page-zero addressing, use a RAM for memory page zero.

Primary fuel cells are those through which reactants are passed only one time.

Before recharging, a zinc-carbon battery must have a working voltage not less than one volt. (Even in technical-writing contexts, rules for one and zero vary. Just pick a style and stay with it. Using the word "one" is the standard in this example.)

Japan has roughly one-third of the US production of dry batteries. (In running text, always write out fraction like this, and hyphenate them. However, you'd still write "5-1/2 inches.")

The radial fractures are so extensive that they are the dominant structural element over half of Mars's surface. (And just to be sure, "half" by itself in running text is always a word.)

A nanosecond is one-billionth of a second.

Inside the UP are three 16-bit registers. (When you have two separate numerical values side by side, one has to be a word, and the other a numeral. Styles vary here, but make the numeral the higher number. Contrast with the next example.)

Data from the frequency counter take the form of 16 seven-bit ASCII words.

Sales of batteries have increased from \$510 million on the average during 1957-1959 to \$867 million in 1966 and are projected to exceed \$1.8 billion in 1980.

The speed of light is roughly 300 million meters per second.

Fifty-three representatives of different software development companies showed up at the meeting. (Never start a sentence with a numeral in any writing context. With this example, some rewriting might be a wise idea to get the numerical out of the beginning of the sentence, as in the following rewrite.)

At the meeting, 53 representatives of different software development companies showed up.

Symbols and Abbreviations

In technical-writing contexts, you may often have to decide whether to use " or ' for "inches" or "feet" or whether to use "inches," "in," or "in."

First of all, remember that symbols and abbreviations are distracting to readers; they are different from the normal flow of words. However, there are plenty of cases where the written-out version is more distracting than the symbol or abbreviation. Also, the context (specifically, technical or nontechnical) has a lot to do with which to use.

Imagine a technical document which has only one or two references to numerical measurements in inches. There is no reason to use symbols or abbreviations here—just write the thing out. But imagine a technical document with numerous feet and inch references: using symbols or abbreviations in this case is better, more readable, more efficient for both reader and writer. But which? Imagine the amount of foot and inch references there would be in a carpentry project (for example, a dog house). In this case, the symbols, " and ' would be greatly preferable. However, this example would be an extreme case; otherwise, use the abbreviations.

When you do use symbols, especially for feet, inches, and some math symbols, use a symbols-type font. Avoid the "smart" quotes for feet and inches. Use the multiplication symbol for measurement contexts.

Which are the standard symbols and abbreviations to use? Go with the standards in the field in which you are writing, or with those found in a standard reference book such as a dictionary. Don't make them up yourself (for example, "mtrs" for meters)!

What about plurals? Very few abbreviations take an s to indicate plural: for example 5 in. means 5 inches. For the few that you think might take the s, check a dictionary.

What about obscure abbreviations and symbols? If you are concerned that readers might not recognize the abbreviation or symbol, write its full name in regular text and then put the abbreviation and symbol in parentheses just after the the first occurrence of that full name.

Examples

High resolution displays use larger video bandwidths, up to 30 MHz or more.

Most touch-sensitive displays use a matrix of either LED/photodiodes or transparent capacitor arrays to detect a physical touch.

The part of the memory that is easily alterable by the operator consists of RAM chips.

A satellite in geostationary orbit looks at the earth with a cone angle of 17.3θ corresponding to an arc of 18,080 km along the equator.

The arc from 53θ W to 139θ W will cover 48 states (excluding Alaska and Hawaii) and is said to provide conus coverage.

Fairchild Industries, Inc., was an early participant in commercial satellites.

The voice was compressed from the usual 64-kb/s pulse code modulation (PCM) to 32 kb/s per channel by near-instantaneous companding (a modified PCM technique).

Terrestrial microwave radio communications require repeaters spaced every 20 to 40 mi from each other.

Over a period of several days the spacecraft is tracked from the ground and positioned on station (i.e., in the preassigned orbital spot) in order to commence operations.

A velocity increment of approximately 155 ft/s per year is required to correct drift problems in satellites.

The ancient battery-like objects made by the Parthians in 250 BC were thin sheets of copper soldered into a cylinder 1.125 cm long and 2.6 cm in diameter.

The standard electrodes are the normal and the 0.1 normal (N) calomel electrodes in which the system is Hg|KCl solution saturated with HgCl.

Such batteries contain 4400 cc of water in which NaOH is dissolved.

Water pressure in the heat recovery loop can be as much as 25 psig.

Resources

Here are some other sources to consult:

Grammar Girl Quick and Dirty Tips for Better Writing

Brian Garner. *Garner's Modern American Usage*. Oxford.

Grammar Book. Provided by Jane Straus.

Bedford St. Martin companion website. Lots of diagnostics and exercises for grammar, usage, punctuation.

Guide to Grammar and Writing. Provided by Charles Darling at Capital Community College.