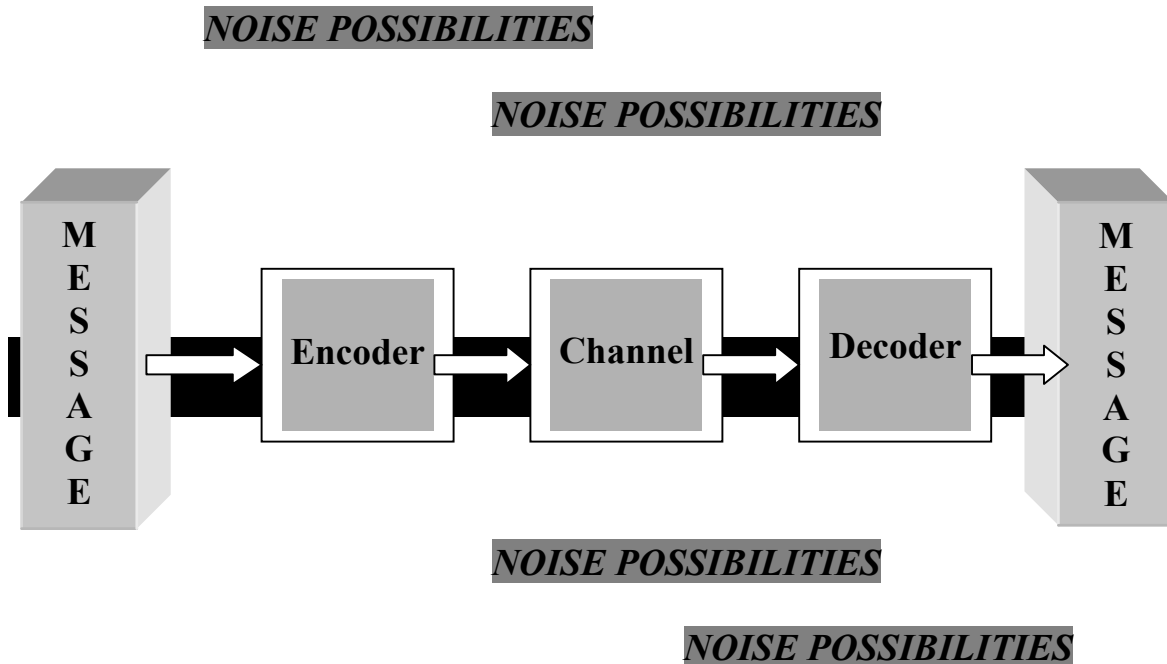


College of Engineering Online Writing Lab Guidebook

Erik Fisher

Clarity

The goal of technical writing is to communicate ideas clearly and efficiently. Anything that hinders this process can be thought of as “noise.” Clear, “noise-free” writing ensures that there is no room for misunderstanding and that readers will not have to work to retrieve your meaning. Figure 1¹ illustrates the process by which a technical document (“channel”) conveys a message from the writer (“encoder”) to the reader (“decoder”). In order for a clear signal to be sent, it must be properly encoded, sent through the proper channel, and be free from distractions, interruptions, and distortion.



¹ (Adapted from Beer and McMurrey (1997))

Figure 1: Noise and the Communication Process

Clear technical writing is a function of many things, including, but not limited to, the following applications:

- Planning and organization of ideas
- Concise, precise, and correct word choice
- Construction of sentences and paragraphs
- Editing and revision.

Concision

Concision, or efficient word choice, is the quality of stating what you mean in as few words as possible. Inefficient word choice, on the other hand, which we will refer to as "wordiness," creates noise and forces readers to spend more time than necessary reading your document. Whereas brief, concise writing allows readers to absorb your message directly, wordiness can annoy readers and undermine their confidence in the value of your work.

Writing with concision requires omitting anything that may distract or slow down your readers. In general, strive to *reduce the ratio of words used to meaning conveyed*. Common forms of wordiness are demonstrated in the following examples. Of course, always be careful not to cut out useful information in an effort to achieve concision.

- **Empty words** — Eliminate “filler” words and phrases that perform no useful function.

WORDY *Needless to say, I have worked in the restaurant for a year and a half and am familiar with the building systems located there as a result.*

CONCISE *After working in the restaurant for a year and a half, I am familiar with the building’s systems.*

WORDY Decreasing *the amount of* background noise would be *an important thing to do* since the Real McCoy is used for *a place of* study as well as *an eating establishment*.

CONCISE Decreasing background noise is important since the Real McCoy is used for studying as well as eating.

- **False sentence structures** — Avoid “there are” and “it is” constructions.

WORDY *There are* several humidity adapters *that* are compatible with most digital multimeters.

CONCISE Several humidity adapters are compatible with most digital multimeters.

WORDY Additionally, *it is intended that* the arrangement of leaf ball fixtures throughout the square *will help* to guide visitors to the restaurant area on the building’s ground floor.

CONCISE Additionally, the arrangement of leaf ball fixtures throughout the square is meant to guide visitors to the restaurant area on the building’s ground floor.

- **Inflated words** — Replace lengthy phrases with shorter equivalents.

WORDY The temperature of the water was *in the neighborhood of* the boiling point.

CONCISE The water’s temperature was near the boiling point.

WORDY *In order to* determine the design requirements, research must be performed.

CONCISE To determine the design requirements, research must be performed.

- **Redundancy** — Avoid unnecessary repetition of words and concepts.

WORDY The building’s construction *first began* with selection of a site *for the building*.

CONCISE The building’s construction began with selection of a site.

WORDY The *separate parts* of the machine will be *assembled together* manually.
CONCISE The machine parts will be assembled manually.

- **Directness** — Feature primary information more prominently than secondary information.

WORDY *After a thorough review of both catalogue values and a limited set of measurements from another project*, the energy savings for a real system were estimated.

CONCISE The energy savings for a real system were estimated from catalogue values and a limited set of measurements.

- **Sentence strings** — Combine two or more sentences when practical.

WORDY One of the entrances was cold and noisy and very uncomfortable. The air traveled into the room from the outside. The rest of the main room was pleasant.

CONCISE Outside air made the entrance cold and uncomfortable, but the remainder of the room was pleasant.

WORDY This project will take an entire semester to complete. It will be very complicated.

CONCISE This complicated project will take an entire semester to complete.

- **Passive voice** — Where appropriate, use active voice to reduce excess words.

WORDY Construction *was performed by* a crew of 1,000 workers who *had been paid by* the government.

CONCISE The government *paid* 1,000 workers to perform the construction.

WORDY The total budget for the proposal *was determined by* a team of accountants.

CONCISE A team of accountants *determined* the total budget for the proposal.

- **Using nouns for verbs** — Reduce the ratio of nouns and noun phrases to verbs.

WORDY *Machining of* the part is accomplished by *using a lathe*.

CONCISE The part is machined on a lathe.

WORDY West's team added *the incorporation of* a pin-and-tether system into the socket set.

CONCISE West's team incorporated a pin-and-tether system into the socket set.

Precision

Effective communication requires using words and phrases that portray the exact, or precise, meaning/attitude they are intended to. Using vague words or phrases can lead to misinterpretation. Precision also refers to the concept of providing sufficient detail in technical writing. This is significant because, without providing adequate support, explanations can begin to sound like personal opinion, rather than useful data. The following examples illustrate some of the ways precision can be neglected and how to correct these problems.

Abstract words and phrases — Writing in abstract terms creates vagueness, which is meaningless to a reader.

ABSTRACT Steel 1020 is a *very strong* material.

REVISED Steel 1020 has a yield strength of 295 MPa.

ABSTRACT The new engineer is *very qualified*.

REVISED The new engineer has 15 years of experience in the software design industry.

Exact meaning — Use words that fit your meaning exactly.

NEGATIVE The *reckless* architect used extremely unconventional ideas in his design.
(Implies the architect is careless.)

POSITIVE The *daring* architect used extremely unconventional ideas in his design.
(Implies the architect is bold.)

Clarify — Give strength to assertions by providing enough information.

VAGUE In order to achieve total body fitness, all of the muscles must be worked with *many different* exercises in order to work them completely.

PRECISE To achieve total body fitness, all muscles must be worked completely; this involves working each muscle with *3 or 4 different exercises*.

VAGUE These stations are unorganized and do not have *proper battery moving equipment*.

PRECISE These stations are unorganized and do not have proper equipment *to efficiently swap out a forklift battery*.

Word Choice

The concept of word choice deals with two separate topics: proper and appropriate use of language. Proper word choice refers to using words in their intended context. Appropriate word choice refers to issues such as specialized vocabulary, socially and culturally biased language, and other forms of slang. These language forms should be avoided because they will result in either confusion or offense. The following examples demonstrate both word choice topics.

Proper — Use words in the appropriate context.

IMPROPER The testimony had a profound *affect* on the jury.

REVISED The testimony profoundly *affected the jury*.

IMPROPER The Cold War *effected* relations between the USSR and the US.

REVISED One of the *effects* of the Cold War was strained relations between the USSR and the US.

Specialized vocabulary — Avoid overshooting the technical knowledge of your audience.

SPECIAL The *HVAC* system is most likely a *VAV*, judging by the air ducts above the ceiling panels and the large box on the roof.

REVISED The *heating, ventilation, and air-conditioning* (HVAC) system is most likely a variable air volume (VAV), judging by the air ducts above the ceiling panels and the large box on the roof.

SPECIAL When the specimen is *stressed in tension*, it experiences *strain* in the *axial and transverse* directions.

REVISED Pulling the specimen causes it to *elongate* in the *longitudinal* direction while *shrinking* in the *horizontal* direction.

Biased language — Biased language is inappropriate in technical writing.

SEXIST An engineer is stimulated by *his* paycheck.

REVISED An engineer is stimulated by *a* paycheck.

SEXIST The *chairman* called the board to a meeting.

REVISED The *chair* called the board to a meeting.

BIASED The *crippled* athletes train in their wheelchairs.

REVISED The *disabled* athletes train to compete in the Special Olympics.

Slang — Avoid casual, imprecise language.

SLANG If we don't begin studying for the final, a whole semester's work *is going down the tubes*.

REVISED A semester's work will be wasted if we do not begin studying for the final.

- SLANG** The car's performance is *out of this world*.
- REVISED** The car's performance is the best in its class.

Sound Sentences

Effectiveness in writing refers to the degree to which the intended message is conveyed, while efficiency in writing describes the level of effort required by the reader to retrieve this intended message. To maximize both effectiveness and efficiency, sentences must be “sound.” There are numerous aspects that make up the concept of a sound sentence, several of which are portrayed by the following examples.

Subject-verb agreement — Subjects and verbs must agree in number (singular and plural).

INCORRECT The engineer *and* the contractor *disagrees* on everything.

CORRECT The engineer *and* the contractor *disagree* on everything.

 Either the engineer *or* the contractor *is* right.

 Neither the engineer *nor* the contractor *is* right.

Verb tense and mood — Shifts in mood and tense can cause confusion.

TENSE SHIFT Specimen one *failed* in tension, while specimen two *fails* in compression.

REVISED Specimen one *fails* in tension, while specimen two *fails* in compression.

MOOD SHIFT *Turn* right at the first light. You *should* then drive two blocks and turn left.

REVISED *Turn* right at the first light. Then *drive* two blocks and turn left.

Point of view — Shifting between different points of view can also cause confusion.

VIEW SHIFT *The team* decided to work on Saturday. *We* worked from 8:00 am until 10:00 pm.

REVISED *The team* decided to work on Saturday. *Everyone* worked from 8:00 am until 10:00 pm.

VIEW SHIFT *We* took an essay exam in our humanities class. *Everyone* was graded on both content and writing ability.

REVISED *We* took an essay exam in our humanities class. *We* were graded on both content and writing ability.

Active and passive voice — The active voice is typically preferred to the passive voice, as it is often more clear and concise.

PASSIVE Integrated into the roof of the penthouse are several environmental systems.

ACTIVE The roof of the penthouse contains several integrated environmental systems.

PASSIVE The principles used in speaker manufacturing were first tested in 1857 by Leon Scott.

ACTIVE Leon Scott first tested the principles used in speaker manufacturing in 1857.

Parallelism — Parallelism refers to expressing similar ideas in parallel grammatical form. Single words should be coupled with single words, and phrases with phrases.

NONPARALLEL The problem could not be solved because of difficulty of computation, lack of time, and *theoretical complexity was increasing*.

REVISED The problem could not be solved because of difficulty of computation, lack of time, and *increased theoretical complexity*.

NONPARALLEL	The building was considered revolutionary because of its architecture, its size, and <i>it took so little time to construct</i> .
REVISED	The building was considered revolutionary because of its architecture, size, and <i>short construction time</i> .

Fragments and run-ons — These types of sentence faults can be very distracting to a reader.

FRAGMENT	Successful engineering requires dynamic problem solving abilities. <i>Demanding both strong creativity and analytical skills.</i>
REVISED	Successful engineering requires dynamic problem solving skills, demanding both strong creativity and analytical skills.
RUN-ON	Freshman engineering courses tend to be very difficult, consequently many students change majors early.
REVISED	Freshman engineering courses tend to be very difficult. Consequently, many students change majors early.

Sound Paragraphs

Continuity in a technical report depends on writing sound paragraphs. A sound paragraph can be qualified in terms of three concepts: unity, organization, and coherence.

Unity — Any individual paragraph should be devoted to one central idea, and all sentences included in the paragraph should relate to this idea. Jumping from one concept to the next within the same paragraph can cause technical writing to be very difficult to follow. The central idea should be introduced by a topic sentence, which is typically the first sentence, but does not have to be. The topic sentence provides a good test to determine whether or not a sentence belongs in a paragraph. If any sentence does not pertain to the subject introduced by the topic sentence, it does not belong in the paragraph. Additionally, to further ensure comprehension and effectiveness of paragraphs, the central idea must be well developed and thoroughly supported. Forms of support include logical argument, specific details, data and analysis, examples, and explanations.

Organization — Paragraph content should be laid out in a logical order. Information that is unorganized will make no sense to a reader and will therefore provide no useful communication. Providing a logical order for information not only makes writing easier to follow, but also allows a reader to pick and choose what to read if time constraints exist. There are many different ways to organize information, including time sequence, spatial sequence, increasing importance, decreasing importance, general to specific, specific to general, and others.

Coherence — Writing that does not read smoothly can be distracting to a reader and detrimental to effective communication. A paragraph's coherence depends on its ability to connect thoughts in a continuous and uniform fashion. Ideas should be clearly linked, and sentences should be connected using pronouns and transitional words and phrases. The following are examples of effective transitional phrases:

- **Cause and effect** — *consequently, as a result, accordingly, hence, thus*
- **Sequence** — *furthermore, finally, in addition, likewise, next*
- **Example** — *for example, for instance, in fact, specifically, to illustrate*
- **Summary** — *in short, in summary, to sum up, that is.*

Punctuation

Commas — Commas, when used properly, organize the sentence and help the reader to grasp its meaning. For example, “If you cook Elmer will do the dishes.”²

Without the appropriate punctuation, this sentence implies that Elmer will be cooked. By simply adding a comma, the meaning of the sentence changes entirely. Commas also create pauses that help the sentence to flow smoothly.

While the list of technical rules for when to use a comma is quite lengthy, a good rule of thumb is to read the sentence out loud to make sure you are not gasping for air by the time you reach the period. If you are, commas are probably needed in order to break up the sentence and give the reader a chance to breathe.

For example, if I, as the writer of a sentence, feel the need to string several thoughts together in a lengthy sentence such as this, it is necessary for me to place commas at appropriate intervals in

order to assist you, the reader, in understanding the meaning that I am attempting to convey. Had I not used any commas as I am doing now it would be much more confusing for the reader to understand what I am trying to relate and my point which is to make the reader pass out from lack of breath will become clear.

As for the technical rules for when commas are to be used, Diana Hacker offers a simple and thorough list.

- ***Between independent clauses joined by a coordinating conjunction*** — For those of us who are not English majors, this means that if you have two mini-sentences that are joined together with a conjunction (such as *and, but, or, nor, for, so, or yet*) to make one big sentence, put a comma before the conjunction.

INCORRECT I miss the beach but I love the mountains.

CORRECT I want to go to New Zealand, so I need a plane ticket.

- ***After introductory phrases*** — Hacker also suggests placing a comma “after an introductory word group.”³ Specifically, commas are necessary after an adverb or participial clause or phrase. In order to find out if a sentence includes such a word group, ask yourself if the phrase answers how, when, or where the action in the main part of the sentence took place.

INCORRECT When she gets to the river Joe’s mom will go kayaking.

CORRECT With unending stamina, he climbed the peak.

- ***Between nouns in a list*** — Commas are also required between nouns in a list, especially between the second-to-last item and the conjunction.

INCORRECT The project required glue nails and a hammer.

CORRECT I bought dog food, anchovies, Spam, and peanut butter.

² (Hacker, 1999, p. 49)

³ (Ibid.)

- ***Between coordinate adjectives*** — Use commas between “coordinate” adjectives, but not between “cumulative” adjectives. Coordinate adjectives can be joined with “and,” while cumulative adjectives cannot.

COORDINATE The new car is a red, shiny, fast vehicle.
 (“red and shiny and fast” **OK**)

CUMULATIVE Her cat has six tiny blind kittens.
 (“six and tiny and blind” **NOT OK**)

- ***To set off nonrestrictive elements*** — A restrictive element clarifies the meaning of the sentence, and does not use a comma. A nonrestrictive element adds further description to the sentence, but is not essential to the overall meaning; such a nonrestrictive element requires a comma to make it stand out.

INCORRECT The report *which* was due was not complete. (nonrestrictive)

CORRECT We needed a fluid *that* was viscous. (restrictive)

CORRECT My dad’s hat, *which* is from his army days, needs washing.
 (nonrestrictive)

CORRECT *Just up the street from the barber,* the diner is in a historical building.
 (nonrestrictive)

To distinguish between a restrictive and nonrestrictive element, determine if the meaning of the sentence is changed without the phrase in place. For example, eliminating the restrictive phrase “that was viscous” removes the clarification of what kind of fluid was necessary. As laboratory students know, lack of such clarification can result in serious consequences. However, “my dad’s hat” needs to be washed whether it “is from his army days” or not; consequently, that phrase is nonrestrictive, and requires commas.

- ***To set off transitional phrases*** — A transitional expression smoothly links sentences or phrases within sentences; “however,” “in conclusion,” “furthermore,” and “for example” are just a few of the many transitional expressions that are used to coordinate sentence flow.

INCORRECT *Moreover* I detest her style.

CORRECT *Furthermore,* the efficiency of the process is questionable.

- **To set off parenthetical phrases** — Parenthetical expressions, like a brief aside, are set off with commas as well. One way to identify a parenthetical expression is to look for a phrase that interrupts the flow of the sentence.

INCORRECT We will *should it be necessary* restrict the hours.

CORRECT Dr. Pierce, *while always one to partake in festivities*, was an excellent surgeon.

- **To set off absolute phrases** — Absolute phrases modify an entire sentence and should be set off with commas.

INCORRECT *As a result of a fatal helicopter crash* Colonel Blake never came home.

CORRECT *Running late for my appointment*, I drove through a red light.

- **To set off contrasted phrases** — Contrasted elements beginning with “not” or “unlike” should be set off with commas.

INCORRECT Oscar *unlike Felix* was very relaxed

CORRECT Iris, *unlike Cedar*, has only three legs.

Semicolons — Semicolons are somewhat like mega-commas; they are more substantial, as they can eliminate the need for a conjunction, and can link otherwise choppy mini-sentences (a.k.a. independent clauses) and reduce wordiness.

CHOPPY The liquid was blue. It was thick. It smelled like Kool-Aid. However, it did not taste like Kool-Aid.

CONCISE The liquid was blue, thick, and smelled like Kool-Aid; however, it did not taste like Kool-Aid.

Technically, semicolons are required in two situations: between independent clauses, and within a list of items that contain internal punctuation.

- ***Between independent clauses*** — As described above, linking independent clauses with a semicolon can help to organize a sentence and also to eliminate the need for a conjunction. In the latter instance, an opportunity to use a conjunctive adverb (e.g., “consequently,” “nevertheless,” “specifically,” “conversely,” etc.) is created; using a conjunctive adverb lends more description to a sentence, which is usually beneficial (unless it creates wordiness), in contrast to the simple conjunctions “and,” “but,” etc.

INCORRECT The floor design of the raft enabled the boat to pivot easily, otherwise a maneuver such as the guide made would not have been possible.

CORRECT The test results proved that the material was ideal for the project; specifically, its heat resistance, deformability, and weight fit the needs of the project exactly.

- ***In a series of complex items*** — When listing a series of complex items that contain their own punctuation, a semicolon is used just as a comma would be used in a case with simpler items.

CORRECT The duties while house sitting include taking care of the dogs, that is, feeding them and taking them for walks; watering the plants (every other day, except for the cacti); bringing in the mail; and, finally, painting the entire exterior of the house with at least two coats of paint.

Do not use a semicolon if a comma will suffice.

INCORRECT Polly has already had ten blisters on her feet; but she says the pain is tolerable and keeps walking.

CORRECT Her feet don’t hurt much now, but just wait until tomorrow!

Colons — Colons are useful tools for alerting the reader that a list, quotation, or appositive (a noun or group of nouns that modify a nearby noun or pronoun) is about to appear. Colons follow an independent clause (a.k.a. mini-sentence), and are also found in ratios, time, between titles and subtitles, and after a greeting in a formal letter. The following examples illustrate appropriate uses of colons:

- **Lists** — When planning a backcountry trip, several items are absolutely necessary: a First Aid kit, food, water, matches, and Twinkies.
- **Quotations** — John Steinbeck was able to describe most people in a single paragraph: “Samuel told Adam Trask that Tom was arguing with greatness. And the father watched his son and could feel the drive and the fear, the advance and the retreat, because he could feel it in himself.” — *East of Eden*
- **Appositives** — My mom is like June Cleaver: a loving wife, caring mother, and cookie baker extraordinaire.
- **Ratios** — The ratio of carnivores to vegetarians was 1:4.
- **Time**— 2:30 pm
- **Formal correspondence** — Dear Mr. Franklin:
- **Titles** — *Materials Science and Engineering: An Introduction*.

Do not use colons if there is not a complete independent clause before the colon.

INCORRECT The items I need at the store are: a hammer, nails, a teddy bear, and garden shears.

INCORRECT During her life she encountered many exciting people, such as: a concert violinist, a monk, an auctioneer, and gypsies.

Numbers

Deciding when to spell numbers out and when to use numerals depends on what type of document you are writing. For scientific and technical writing, it is generally best to use numerals whenever a number is being expressed. For nonscientific documents, spell out numbers less than one hundred and round numbers; use this rule along with the terms *million* and *billion* for numbers larger than one million, e.g., four billion, 176 billion, 7.2 million. The rules that follow apply mainly to scientific documents.

When to spell numbers out — The prevailing rule, regardless of the type of document you are writing, is to spell out a number if it is at the beginning of a sentence. Ideally, you should try to reword the sentence so that the number appears elsewhere.

INCORRECT 3 millimeters were recorded.

CORRECT Three people showed up to the meeting.

Always spell out the pronoun “one” as well.

CORRECT As an engineer, one should always consider the standards of safety.

When to use numerals — While the rules vary from writing guide to writing guide, one widely used convention in technical writing is to use numerals for all numbers greater than ten. Moreover, use numerals to express measurements, numerical results, dates, time of day, pages, figures, percentages, and numbers that require more than two words to spell out.

CORRECT 30 ml; equals 142; October 3, 1999; on page 12; see figure 1; 35%;
172

For a number that immediately follows another, spell out the number that can be written with fewer words, and use numerals for the other.

CORRECT 42 three-hole punches

If one of the numbers is a unit of measure, try to use numerals for the measurement and spell out the other number.

CORRECT seventeen 23 cm samples

Basic Grammar

One’s integrity as a writer depends heavily on grammar. Grammatically faulty documents will decrease the reader’s comprehension of what the author is trying to say, as well as demonstrate the writer’s inability to use basic communication skills.

Nouns and Pronouns — Nouns are one of the easier parts of speech to recognize. Quite simply, a noun is a person, place, thing, or idea. The italicized words in the sentence that follows are

nouns or noun-equivalents: *Schrodinger* proposed the *equation* that governs the waves' *behavior* and earned *him* the 1933 *Nobel Prize*.⁴

Although “waves” is typically a noun, in this example it is acting as a modifier; that is, it is describing what kind of behavior the equation governs.

The word “him” is a *pronoun*, a convenient word that refers to a specific noun and thus functions as a noun. Pronouns help the writer avoid repetition resulting from using the same word repeatedly.

Several different kinds of pronouns exist, including the following:

- **Personal** — I, you, him, her, it, we, they, she, he
- **Possessive** — my, mine, your, his, her, hers, its, ours, their
- **Relative** — that, who, whom, whoever, which, whose
- **Demonstrative** — that, these, those, this
- **Reflexive** — myself, yourself, herself, ourselves
- **Indefinite** — everything, anyone, somebody, several, nothing, something, none, few.

In the example above, it is clear that “him” is Mr. Schrodinger. In the sentence that follows, however, the pronoun “he” is ambiguous: While both Dr. Callister and Dr. Young worked on the electron-scanning device, *he* was the only one to receive recognition.

Here, the inappropriate use of the pronoun “he” leaves the reader unclear as to which doctor actually received recognition.

Unclear pronoun use forces the reader to perform work that the author has neglected.

Furthermore, it can result in confusion and—even worse—misunderstanding.

Make sure, therefore, that the noun to which a pronoun refers has already been introduced and that it will be obvious to the reader *which* noun the pronoun refers to.

⁴ (Taylor & Zafiratos, 1991, p. 193)

Another frequent misuse of pronouns occurs when there is no noun-pronoun agreement. Similar to subject-verb agreement, the number represented by the noun must be reflected in the pronoun or verb. For instance,

INCORRECT The spacing of the streamlines is wider below the wing than above *them*.⁵

CORRECT The spacing of the streamlines is wider below the wing than above *it*.

The pronoun “them” is supposed to refer to the wing; however, only one wing is introduced, so the incorrect “them” should be replaced with “it.” Since the noun is singular, the pronoun must also be singular.

Noun-pronoun agreement is frequently overlooked when “their” or “theirs” is used to avoid gender-biased language.

INCORRECT When *an engineer* applies for a new position, *their* resume should be free of typos.

CORRECT When *an engineer* applies for a new position, *his or her* resume should be free of typos.

CORRECT When *engineers* apply for new positions, *their* resumes should be free of typos.

While it is important to avoid sexist language, the plural pronoun “their” does not agree with the singular noun “engineer.” Remedies for this problem include using “his or her,” or making the noun plural so that the pronoun (and the rest of the sentence) agrees with it.

Verbs — Verbs are words that designate action. Several common mistakes involving verbs can be easily corrected if the writer is aware of them.

- **Subject-Verb Agreement** — One of the most frequent errors is subject-verb agreement. Like noun-pronoun agreement, it is imperative that a verb agrees with its subject in number.

Incorrect subject-verb agreement frequently arises when an object is placed between a subject and its verb.

⁵ (Halliday, Resnick, & Walker, 1997, p. 461 (altered))

INCORRECT The high electrical *conductivity* of metals *require* that there be one or more electrons that are easily detached from their atoms.⁶

CORRECT The high electrical *conductivity* of metals *requires* that there be one or more electrons that are easily detached from their atoms.

Note that the subject of the verb “require” is “conductivity,” and not “metals,” which is the object of the preposition “of.” Since the subject “conductivity” is a singular noun, the verb must be altered to “requires” in order to accommodate the correct number.

Moreover, one must pay attention to nouns joined with a conjunction: while nouns linked by “and” usually make up a plural subject, those joined by “or” usually remain singular:

CORRECT Deformation and slip in polycrystalline materials *are* somewhat more complex.⁷

CORRECT A rope or cable attached to an object *exerts* a force on the object.⁸

These examples illustrate correct subject-verb agreement in cases where the distinction is not obvious.

- ***Tense Consistency*** — Many writers unknowingly switch from past to present tense, or vice versa, within a single document. These occurrences are sometimes more difficult to catch, and often only very careful proofreading will alert the writer to the error. In reports where procedures are described, this mistake is quite easy to make.

TENSE SHIFT They *cooled* sodium atoms to a few millionths of a degree above absolute zero with a laser, and *trapped* them in a magnetic field. The scientists then *cool* the atoms even further by evaporating off the hottest atoms.⁹

REVISED They *cooled* sodium atoms to a few millionths of a degree above absolute zero with a laser, and *trapped* them in a magnetic field.

⁶ (Taylor & Zafiratos, 1991, p. 287 (altered))

⁷ (Callister 2000)

⁸ (Bedford & Fowler, 1999, p. 87)

⁹ (Agrawal, 1999, p. 32)

The scientists then *cooled* the atoms even further by evaporating off the hottest atoms.

The author, after using the past tense (“cooled,” “trapped”) has unconsciously begun writing in the present tense (“cool”). Awareness of this commonplace error should help one to avoid it.

Some lab reports require the writer to describe theory using present tense and procedure using past tense. In such cases, make sure that the boundaries separating the sections that use different verb tenses are distinct and not crossed.

- **Active and passive voice** — The active voice is typically preferred to the passive voice, as it is often more clear and concise.

PASSIVE The mass *is held* in place by two wedges.

ACTIVE Two wedges *hold* the mass in place.

Using the passive voice allows the writer to emphasize the receiver of the action (“the mass”). When such emphasis is appropriate, the passive voice is acceptable. On the other hand, the active voice is more direct, vivid, and concise. This fact makes the active voice a better choice in most cases.

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