Technical and Scientific Prose Style

How to write concisely, precisely, and directly.

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The Gunning Fog Index

One of the most widely used methods to determine readability is the Gunning-Fog Index.

It uses an algorithm to determine the number of years of education your reader would need in order to understand the paragraph you write.

You can obtain your Gunning Fog Index by cutting and pasting a paragraph of your writing into this **free tool**.

Fog Index and Reading Levels

The index score of the previous slide is **14.31.** For reference, here are some Fog Index scores by publication with the reading levels needed.

Now I know why I dislike reading anything from the government.
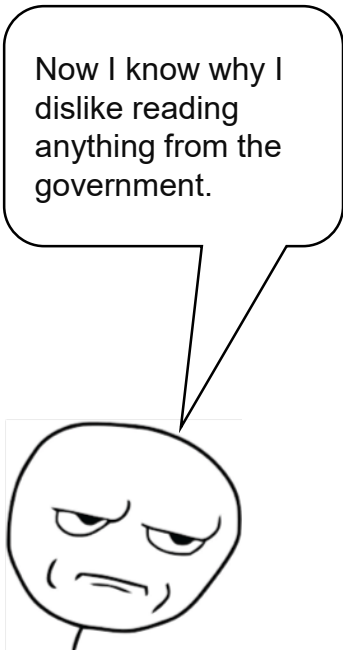
Publication	Fog Index	Reading Level Needed
US Government Publications	20+	Post-Graduate Plus
Academic Journal Articles	17-20	Post-Graduate
Medical Consent Forms	13-16	College Junior to Senior
New York Times and other popular publications	11-12	High School Junior to Senior
National Geographic	10	High School Sophomore
Bible	7	7th Grade

Foggy Prose and Oppenheimer's Research

Many people, particularly academic types, like to write technically dense prose that scores high on the fog index. Daniel Oppenheimer, a psych professor at Princeton, wondered whether this helps or hampers them.

So, he did did some experiments and published his findings in the journal of Applied Cognitive Psychology with this crazy title:

- "Consequences of Erudite Vernacular Utilized Irrespective of Necessity: Problems with Using Long Words Needlessly."

Oppenheimer's Research Won the Ignoble Prize

In 2006, Oppenheimer was awarded the Ig Nobel Prize. These awards are given for research that first makes people laugh and then makes them think.
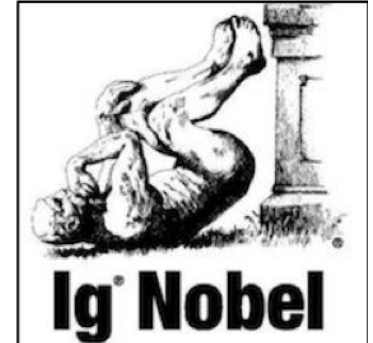
At the ceremony, he gave what many believe is the perfect acceptance speech. Here it is in its entirety:

- "My research shows that conciseness is interpreted as intelligence. So, thank you".

Being concise is one of three concepts important to achieving a readable technical / scientific style. The other two are being precise, and being direct.

Prose Style Concept 1:
Be Concise

To be concise means to be **brief** (of short length) yet **comprehensive** (containing all information). So, how do you do both things?

Write only the words necessary to meet your audience needs and your purpose for writing. No more and no less.

One of the biggest obstacles to developing a concise prose style is padding your sentences with lard.

Eat Lard but Don't Pad Your Writing with It.

Padding your prose with words that do not contribute to meaning is writing lard.

We love lard.

Yes, but we only eat it, we NEVER write it.

What Causes Lard?

The most common reason students develop the habit of writing lard is trying to reach word or page counts.

Most teachers do not insist that you meet a specific word count or number of pages.

Okay, well, maybe my 8th grade English teacher did, but she was a bit strange.

Who are you calling strange sister?

About Word Counts and Page Lengths

In school, word count and page length guidelines should cue you to think about the level of **development** your writing will need.

Padding your writing by adding unnecessary words is not developing the content. It's just adding lard, and it's a bad habit to get into.

The following slides will help you analyze your prose style to determine if you have developed this habit, and how to stop writing lard-laden sentences and be concise.

Eliminate Unnecessary Repetition

Look for any words or phrases you have repeated and think about whether the repetition is serving a purpose or if it's just padding.

Example of Unnecessary Repetition:

- The length of the transistor is related to its **junction depth**. The **junction depth** can be reduced by lowering the implant energy.

Revised to Eliminate Unnecessary Repetition:

- The length of the transistor is related to its junction depth, which can be reduced by lowering the implant energy.

Eliminate Redundant Words and Phrases that
repeat the same meaning as other words.

~~already~~ existing

~~alternative~~ choices

~~at the present time~~ presently

~~basic~~ fundamentals

currently ~~at this time~~

~~completely~~ eliminate

continue ~~to remain~~

~~had done~~ previously

introduced ~~a new~~

mix ~~together~~

now ~~at this time~~

~~private~~ industry

~~the reason being~~ because

silver ~~in color~~

start ~~out~~

~~still~~ persists

whether ~~or not~~

~~first~~ began

period ~~of time~~

~~empty~~ space

Are you writing dead phrases?

A dead phrase has a pompous tone and is not saying anything necessary.

- it is my intent to show
- as a matter of fact
- as is well known
- as stated earlier
- it is noteworthy
- it goes without saying

Are you writing unnecessary modifiers?

In technical and scientific writing, unnecessary modifiers are too vague.

But, they may be useful in other types of writing such as an academic essay.

So if you are analyzing your prior writing for unnecessary modifiers, keep the purpose and genre of your writing in mind.

Examples:
- Actually
- Really
- Basically
- Very
- Definitely
- Somewhat
- Probably
- Extremely
- Practically

Summary: to analyze your writing for Being Concise

Check your writing for

- Lard

- Redundant words and phrases,

- Dead phrases,

- Unnecessary modifiers.

Prose Style Concept 2:
Be Precise

To *be precise* means to be **exact** and **accurate.** In technical writing, how precise you need to be is based on the audience.

- When writing to audiences with a **low-level of technical expertise,** do not use technical terminology that is so **exact** the audience would not understand what you mean.

AND

- When writing to an audience with a **high level of technical expertise** use technical terminology that is more **accurate** than common words and phrases.

Audiences with a low-level of technical expertise need less precise terminology.

A bid proposal to homeowners about the cost of paving their driveway would not use these technical terms:

- *The cost to pave your driveway using a mix of **aggregate** bonded with **calcium** to form an **agglomerate** will be . . . .*

- The word **"concrete"** is precise enough.

Audiences with a high-level of expertise need more precise technical terminology.

Needs to be more precise:

- Our research presents a new technique for studying the complex phenomena associated with the development of **sparks** *and other* **gas** discharges.

Audiences with a high-level of technical expertise would question why the author is conflating sparks and gas discharges because these are different, so the writing is not precise.

Are you using terms consistently?

Although **young drivers** say they believe that distracted driving is a problem, our **tests** revealed that over 90% of **teenage drivers** still engage in distracted driving behaviors. The objective of this **study** was to **survey** the effectiveness of involving **students** in the production of public service announcements (PSA). The PSA's were aimed at changing the disconnect between what **drivers** say they believe and what they do. Our **experiment** revealed that when **students** produced PSA's, these announcements were more effective in changing this disconnect. (inconsistent use of terms)

- Was it a test, study, survey, or an experiment?

- Were they young drivers, teenage drivers, all drivers, or just students?

NOTE: in some disciplines the word "study" refers to all of the research that was done and the methodology then names the specific type of research that was done (i.e. a test or experiment etc.).

Level of specifics and detail.

To determine if specifics and detail are at the right level, you need to think about audience and your purpose for writing.

Example:
A mailing address is specific and contains the details necessary for someone to send you mail or a package.

The specifics and details of a mailing address, however, would not be enough to identify property in a mortgage contract.

- *Different audiences --- Different purposes ---- Different needs.*

Summary: to analyze your writing for Being Precise

Check:

- If you are writing technical terminology appropriate to the audience's level of technical expertise,

- If you are being consistent in using terminology,

- If the level of specifics and details are appropriate to meet audience needs and your purpose for writing.

Prose Style Concept 2:
Be Direct

To be direct means to be **straightforward** and to write straightforward prose, you need to use:

- **mostly active verbs,**

- **mostly active voice** (but know when passive is a better choice),

- **topic position**

- **stress position**

Are your verbs active or lazy?

Lazy verbs are generic and vague:

- The results of this study **show** . . . .
- This study **dealt with** . . .
- The test **involves** . . .

Active verbs are specific and reveal analytical thinking:

- The results of this study **challenge** . . .
- This study **characterizes** . . .
- The test **measured** . .

Here is a [useful active verb list](#) to use if you need to find the right active verb.

Does your writing use passive verbs appropriately?

To be verbs are **passive** because they cannot convey action only a state of being: **is, are, was, were, etc.**

When defining a word or something else, a passive verb fine.

- *A positron **is** a positively charged electron.*
- *A volcano **is** a rupture in the crust of a planetary-mass object.*
- *Chemists **are** scientists trained in the study of chemistry.*

Are you using passive verbs needlessly?

Needless use of passive verbs:

- A new process for eliminating nitrogen oxides from diesel exhaust engines *is* presented. Flow tube experiments to test this process *are* discussed. The percentage decrease in nitrogen oxide emissions *is* revealed.

Revised with active verbs:

- This paper *presents* a new process for eliminating nitrogen oxides from the exhaust of diesel engines. To test this process, we *performed* experiments in flow tubes. These experiments *revealed* a 99 percent decrease in nitrogen oxide emissions.

Don't confuse passive **verbs** with passive **voice**.
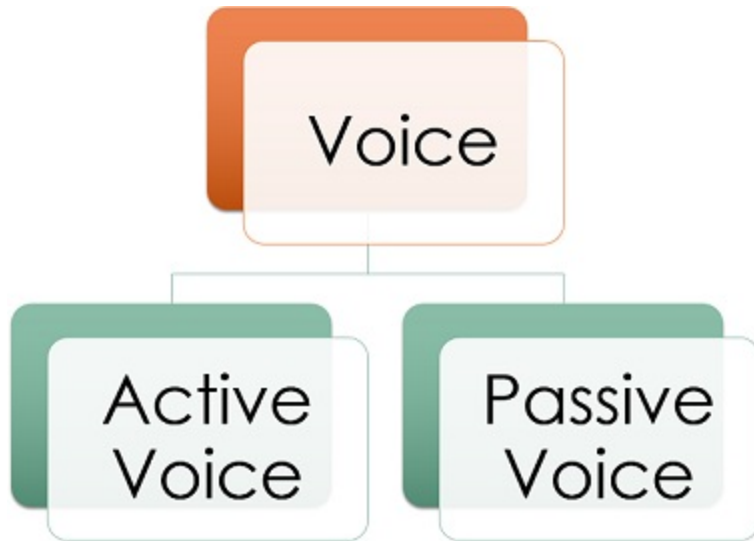
Not every sentence that uses a passive **verb** is in passive **voice**.

You should use mostly active voice but know when passive is a better rhetorical choice.

Active Voice

Active voice means the **subject** of a sentence is doing the action.

- John washed the car.
  "John" is the subject, and he is also doing the action.

- *Passive voice* means the **object being acted upon** is the **subject** and who is doing the action is not given (or added with a "by" phrase).

- The car was washed.
  The car was washed by John.
  "Car" is now the subject and who is doing the action is either not given or added the "by" phrase.

About using grammar checkers.

Grammar checkers will count the number of passive **verbs** (is, are, were, was, etc.) But, a passive **verb is not** the same as passive **voice**.

- John is washing the car.
- The volcano is erupting.

The two sentences above use passive verbs but are in active voice (remember if the subject is doing the action, it's active).

Instead of using a grammar checker to determine if you are writing in passive voice, try using the zombies' test.

The Zombies' Test for Passive Voice

If you can add "by zombies" at the end of your sentence, it's passive.

- The experiment was conducted in the lab. (is it passive?)

- The experiment was conducted in the lab *by zombies. (yes)*

But, just because a sentence is in passive voice doesn't mean you should change it to active voice.

You need to know when to use mostly active voice vs. when passive voice is a better rhetorical choice.

When to use passive voice.

In technical and scientific prose style, passive voice is **preferred** when *what was done* is more important than *who did it.*

Examples:

- DNA **was extracted** . . .
- Test holes **were bored** . . .
- Samples **were taken** . . .
- Surveying **was done** . . .

When to be careful with active voice.

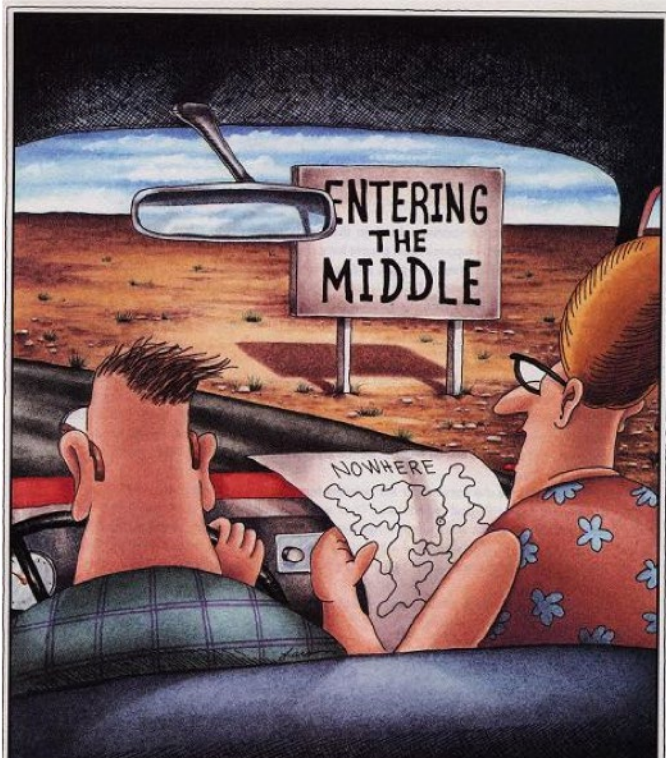When using active voice with an inanimate object, avoid the Frankenstein effect.

Reasonable:
• The oscilloscope **displayed** the voltage.
• The oscilloscope **measured** the voltage.

Not reasonable: It's Alive!
• The oscilloscope **calculated** the voltage.

IT'S ALIVE

Are you using the topic position?

The beginning of a sentence or paragraph sets up the topic, so it is referred to as the **topic position.**

Readers use the topic position, to get a sense of where a sentence or paragraph is going to take them.

If you don't use the topic position, readers will get lost or confused.

Try reading this.

She first tried setting loose a team of gophers. The plan backfired when a dog chased them away. She then entertained a group of teenagers and was delighted when they brought their motorcycles. Unfortunately, she failed to find a Peeping Tom. Furthermore, her stereo system was not loud enough. The crab grass might have worked, but she didn't have a fan that was sufficiently powerful enough to blow the seed. She made obscene phone calls that gave her hope until the number was changed, so she decided to hang up a clothesline. It was the installation of blinking neon lights she bought that did the trick. She eventually framed the ad from the classified section.

- *It doesn't make any sense right?*
- *That's because it needs a topic sentence.*

Now, try it with with topic sentence added.

Sally disliked her neighbors and wanted them to leave the area. She first tried setting loose a team of gophers. The plan backfired when a dog chased them away. She then entertained a group of teenagers and was delighted when they brought their motorcycles. Unfortunately, she failed to find a Peeping Tom. Furthermore, her stereo system was not loud enough. The crab grass might have worked, but she didn't have a fan that was sufficiently powerful enough to blow the seed. She made obscene phone calls that gave her hope until the number was changed, so she decided to hang up a clothesline. It was the installation of blinking neon lights she bought that did the trick. She eventually framed the ad from the classified section.

- *All of the details now make sense because the topic sentence provides the point of the paragraph.*

Are you using the stress position?

Readers place greater emphasis on information that is at the **end** of a sentence, paragraph, or chapter.

It's where they look to figure out the point a writer is making. This placement is known as the *stress position* or *stress emphasis.*

If the ending leaves readers wondering what the sentence or paragraph means, it's like never arriving at a destination.

How to check the stress position.

Look at the end of your sentences. Are the words in the stress position saying what you want to emphasize? If not trim the end.

- Sociobiologists claim genes control our social behavior ~~in the way we act in situations we are in every day.~~

Since social behavior means the way we act in situations, the words at the end are unnecessary and throw the emphasis off in this sentence.

Dead phrases are often in the stress position.

- Job opportunities in computer programming are getting scarcer, ~~it must be remembered.~~

- Remember from the prose style concept about being concise that dead phrases sound preachy and pompous and are not saying anything meaningful.

- Get rid of dead phrases no matter where they show up in your sentence.

Strings of preposition make it hard for readers to find the emphasis you intend.

The condition **of** the patient was documented **in** the patient profile written **by** the nurse **on** duty during the after-hours shift.

Eliminate strings of prepositions by being direct which will make the stress position clearer.

- The after-hours nurse documented the patient's condition in the patient profile.

Summary: to analyze your writing for Being Direct

Check if you are writing:

- mostly active verbs,
- mostly active voice know when passive voice is preferred,
- topic sentences,
- and check if what you want to emphasize (your point) is in the stress position.