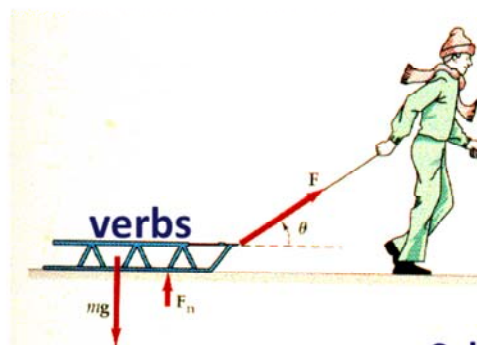


## Voice, Person, Tense— Making Verbs Work



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In this class, we'll look at how proper verb choice can improve the clarity and vigor of your scientific writing.

**Verbs provide the momentum of writing**

A cartoon illustration of a prairie dog sitting upright. A thought bubble above it contains the text: "I always use wimpy verbs and complicated syntax; sounds more 'scientific.'"

**Proper verb choice makes the difference between clumsy, bloated writing and crisp, direct narrative**

The proper selection and use of verbs can be the difference between clumsy, bloated narrative and crisp, direct scientific writing.

Our friend is wrong here; the purpose of scientific writing is to **convey meaning concisely and unambiguously**; if it sounds convoluted and hard to understand, it's not good writing.

"Any intelligent fool can make things bigger and more complex... It takes a touch of genius—and a lot of courage—to move in the opposite direction."

*Albert Einstein*

## Replace wimpy verb phrases with strong action verbs

### Weak verb phrases

made a determination  
performed a measurement  
carried out the analysis

### Strong verbs

determined  
measured  
analyzed

**The human immune system is responsible not only for the identification of foreign molecules, but also for actions leading to their immobilization, neutralization, and destruction.** (25 words)

*The human immune system not only **identifies** foreign molecules, but also **immobilizes, neutralizes, and destroys** them.* (16 words, vigorous, more direct)

Instead of worrying about passive vs. active, replace weak verb phrases and “is” verbs with “action” verbs—they are always more concise, and they will make your writing crisper and more direct.

**Change nouns ending in *-tion*, *-ment*,  
and *-ance* back into their native verbs**

**A numerical approach was devised that enables the fast and efficient determination of the ternary diagrams associated with our Gibbs free energy.**

(22 words)

***A new numerical approach quickly and efficiently determines the ternary diagrams associated with our Gibbs free energy .*** (17 words, more direct)

**Measurements were taken of variations in pressure as a function of temperature.** (11 words)

***Pressure was measured as it varied with temperature.***

(8 words)

**“More concise” usually means “easier to understand”—  
which should be your goal in all scientific communications**

In English, for many words derived from Latin, we transmogrify verbs into nouns by adding “-tion,” “-ment,” or “-ance” to the root word. So “act” becomes “action,” “arrange” becomes “arrangement,” and “perform” becomes “performance.”

An easy way to improve the directness and conciseness of your writing is to change every *-tion*, *-ment*, and *-ance* word back into its original verb.

## Don't jump back and forth between present and past tense

### Horrible example:

“A single beam of light *was directed* obliquely into a waveguide formed by two parallel, movable mirrors. The beam *experienced* multiple reflections from the mirrors and *propagates* as a combination of many modes. Each mode *interferes* with every other mode, which *led* to a modulation transmitted through the waveguide. The number of reflections within the multimode waveguide interferometer *determines* the device's sensitivity.”

The last verb (*determines*) should be in the present tense, because it is a *time-independent fact*

Everything you *did* should be written in past tense to make clear what you've done

I think the strongest argument that can be made for using the past tense in papers is that doing so makes what you've actually **done** clear.

Here's an abstract from arXiv that is a good example of what I mean (arXiv:1101.3846):

“The magneto-transport of a superconducting/ferromagnetic hybrid structure consisting of a superconducting thin film in contact with an array of magnetic nanodots in the so-called "magnetic vortex-state" exhibits interesting properties. For certain magnetic states, the stray magnetic field from the vortex array is intense enough to drive the superconducting film into the normal state. In this fashion, the normal-to-superconducting phase transition can be controlled by the magnetic history. The strong coupling between superconducting and magnetic subsystems allows characteristically ferromagnetic properties, such as hysteresis and remanence, to be dramatically transferred into the transport properties of the superconductor.”

So what exactly did the authors **do** that they're reporting in this paper? The abstract, written in the present tense, sounds like a collection of already known facts. It's not clear (at least to me) what the authors have contributed.

## **Avoid unruly verb forms as well as tense flips**

**A solution including DNA *is dropped* on the sample. The liquid *dries*, and with any luck, some of the DNA *has landed* across the trench, *creating* a perfect nanoscale bridge.**

***A solution containing DNA was dropped onto the substrate, and some of the DNA strands landed such that the ends of the strand lay on opposite sides of the trench. As the liquid evaporated, a perfect nanoscale “bridge” remained.***

The first example, which was taken from a student’s senior thesis draft, has several writing flaws, besides the out-of-control verbs.

- 1) It’s generally better not to attribute any of your scientific results to “luck.” “Hope” should also be avoided in scientific writing.
- 2) Solutions don’t “include” things, they “contain” them. And liquids don’t “dry”; they “evaporate.” Train yourself to use language precisely.

## **Use parallel construction throughout**

### **In verbs in sentences**

**“Further possible experiments include *stopping* an antiproton in a Cerenkov detector and the *observation of* antiproton annihilation in a cloud chamber.”**

**“Further experiments could include *stopping* an antiproton in a Cerenkov detector and *observing* antiproton annihilation in a cloud chamber.”**

### **In lists and series**

**“The process involves three main steps: *cooling, pulverization, and being screened.*”**

**The process involves three main steps: *cooling, pulverizing, and screening.*”**

“Parallel construction” is a rhetorical device whereby items in a series are expressed in the same grammatical form. Faulty parallelism is not merely inelegant; it often leads to wordiness and ambiguity.

## Learn to spot faulty parallelism

**“Once the earthquake has subsided, you are not yet out of danger. Often the electricity has gone out and it is dark. However, striking a match or an open flame may cause a gas explosion.”**

### **Ms. P’s rewrite:**

**“During earthquakes, danger may still exist after the ground stops shaking. Breaks in electrical lines could interrupt electrical service and cause loss of lighting. And leaks from natural gas lines could result in explosions if a flame from a match or a candle were used for illumination.”**

**Although my version is 12 words longer, I think it is more specific, and the language is much more precise**

This example of faulty parallelism is taken from Michael Alley’s *Craft of Scientific Writing* (q.v. <http://www.writing.engr.psu.edu/exercises/grammar2.html#s2>):

The verb phrase “striking a match” is not parallel with the noun phrase “an open flame.” What the author has written is that you should not “strike” a match or an open flame. (How do you “strike” an “open flame”?—sounds dangerous to me.) You can correct this sentence by either making both elements in the series verb forms (“striking a match or creating an open flame”) or making them both noun forms (“a lit match or an open flame”).

The faulty parallelism is only part of the problem, however.

### Ms. Particular quibbles:

1. Earthquakes don’t “subside” (although sections of the earth might subside during an earthquake); the tremors cease.
2. “Electricity” doesn’t “go out”; electrical service fails.
3. Natural gas doesn’t explode unless it leaks into the air.

Try Alley’s writing exercises yourself at <http://www.writing.engr.psu.edu/exercises/>.



## **What's wrong with this sentence?**

**“The development of the theory of convection began some 85 years ago with Lord Rayleigh’s analysis of instability in fluids heated from below, but it was not easy for geoscientists to accept that a mechanism applicable to a fluid like water could also be relevant to understanding the behavior of the solid mantle composed of silicates.”**

It's impossible to understand the meaning of this long, convoluted sentence on the first reading. Even if you're a native English speaker.

Even if you're a geophysicist.

## What's wrong with this sentence?

**“The *development of* the theory of convection began some 85 years ago with Lord Rayleigh’s analysis of instability in fluids heated from below, but *it was not easy* for geoscientists *to accept* that a mechanism applicable to a fluid like water could also *be* relevant *to understanding* the behavior of the solid mantle *composed of* silicates.”**

**It’s too long—56 words!**

**It uses noun-ified verbs (*development of*)**

**It uses “to be” verbs instead of active verbs**

**It uses infinitives and gerunds instead of active verbs**

**It violates the three-preposition rule\* (10 preps)**

One of the easiest ways to improve your writing is to write short (<25 words) declarative sentences using active verbs. If you routinely write sentences containing more than 25 words, you likely have long strings of prepositional phrases, weak verbs, misplaced modifiers, and indefinite pronoun references—all leading to difficulty in interpreting your meaning.

Refer to Ms. P on “like,” which is used incorrectly in the example, but that’s a rant for another day. (q.v. <http://people.physics.illinois.edu/Celia/MsP/Like.pdf>)

## **Here's how to fix it:**

**“Convection theory began some 85 years ago, with Lord Rayleigh’s analysis of instabilities in fluids heated from below. While convection clearly explained the behavior of fluids, geoscientists were reluctant to apply the theory to movement in the Earth’s solid silicate mantle.”**

**Two sentences of ≈20 words each**

**Verbs are verbs**

**Concise and direct**

## **What else is wrong with this sentence?**

**“The development of the theory of convection began some 85 years ago with Lord Rayleigh’s analysis of instability in fluids heated from below, but it was not easy for geoscientists to accept that a mechanism applicable to a fluid like water could also be relevant to understanding the behavior of the solid mantle composed of silicates.”**

**Did you spot the 4LW in the original?**

**“...that a mechanism applicable to a fluid  
like water”**

**Before:**

**“The development of the theory of convection began some 85 years ago with Lord Rayleigh’s analysis of instability in fluids heated from below, but it was not easy for geoscientists to accept that a mechanism applicable to a fluid like water could also be relevant to understanding the behavior of the solid mantle composed of silicates.”**

**After:**

**“Convection theory began some 85 years ago, with Lord Rayleigh’s analysis of instabilities in fluids heated from below. While convection clearly explained the behavior of fluids, geoscientists were reluctant to apply the theory to movement in the Earth’s solid silicate mantle.”**

## Use “is” verbs judiciously

### Weak verb phrases

is beginning  
is used to control

### Strong verbs

begins  
controls

### Restrict *is* to sentences that *define* or *equate*

“A positron *is* a positively charged electron produced in the beta decay of neutron-deficient nuclides.”

### Use a strong verb in sentences that do not present a definition or equality

“Generally, a storage ring *is used* not only to store charged particles, but also to *define* their energy and trajectory.” (20 words)

“Generally, a storage ring not only *stores* charged particles but also *defines* their energy and trajectory.” (16 words, more direct)

Your writing will almost always be more concise if you use an “action” verb instead of an “is” verb form.

**Avoid beginning sentences with indirect preambles (“There are...” “It is”)—use the passive voice and plunge right in**

~~“There were~~ several methods used to produce the thin metal substrates—hot stamping, cold rolling, and cleaving.”

“Thin metal substrates were produced by several methods—hot stamping, cold rolling, and cleaving.”

**This rewrite has the added advantage of putting the important part of the sentence (“thin metal substrates”) first and the examples directly after “methods,” where they belong (and the PV version is three words shorter, too!)**

Train yourself to spot “There is...” and “There are...” sentences and rewrite them in the passive voice, which puts the important point first in the sentence (“front loads”).

**I've heard about a controversy  
regarding "voice" in science writing**



**What's *that* all about?**


**\*Reddit smackdown between a hip young professor  
from Stanford and an old-school editor from Illinois:  
<http://redd.it/30x20y>**




**Before we jump into the fray, let's review**

**Active voice: the subject of the sentence performs the action—the subject acts**

**Passive voice: the subject of the sentence receives the action of the verb—the subject is acted upon**



The pitcher throws the ball.



The ball is caught by the catcher.

**Editorial advice from the ACS: “Use the passive voice when the doer of the action is unknown or not important.”**

A. Coghill, et al., *The ACS Style Guide* (American Chemical Society, Washington DC, 2006), Chapter 4  
<http://pubs.acs.org/doi/abs/10.1021/bk-2006-STYG.ch004>

The active voice uses direct, action verbs, and the subject of the sentence *does* the action.

The passive voice uses “to be” verb forms, and the subject of the sentence *receives* the action.

The active voice is always more direct and is usually more concise, because it may avoid the need for clarifying prepositional phrases.

The “rule” for years has been that scientific papers should be written in the third-person passive voice, but that rule is breaking down, because passive voice can be awkward and wordy in the hands of amateurs.\*

From the *AIP Style Manual*, 4<sup>th</sup> ed. (New York, American Institute of Physics, 1990), p. 14:

“The old taboo against using the first person in formal prose has long been deplored by the best authorities and ignored by some of the best writers... The passive is often the most natural way to give prominence to the essential facts: Air was admitted to the chamber. (Who cares who turned the valve?) But avoid the passive if it makes the syntax\*\* inelegant or obscure...”

\**We remain unmoved by this argument.*

\*\**The arrangement of words in a sentence.*

**Scientific writing has traditionally  
been third person, passive voice...**



**First person: I, we**

**Second person: you (singular), you (plural)**

**Third person: he, she, it, they**

**...but more editors are allowing—  
even encouraging—first person, active voice,  
because it may be more direct and concise**

*(or maybe because so many scientists write passive voice so badly...)*

***“So many papers deserve to be better written than they are.”***

*“Elements of Style,” Nature Physics 3, 581 (2007) doi:10.1038/nphys724*

AIP makes an exception for the acknowledgments section:

“...(ii) Even those who prefer impersonal language in the main text may well switch to “I” or “we” in the acknowledgments, which are, by nature, personal.”

## The passive voice offers two distinct advantages in scientific writing

- 1. Focuses the reader's attention on the method, result, or principle being described (who cares who added the reagent to the beaker?)**
- 2. Presents findings and ideas in a neutral, facts-based, objective way**

*“However, there is a clear prejudice among today’s commentators on voice—particularly those who express themselves in writing textbooks—against one of the commonest types of prose, **report writing, where the passive voice is not only common, it is generally less wordy than the active, more direct, and more efficient in conveying information.**”*

Dennis Baron, “The Passive Voice Can Be Your Friend,” in *Declining Grammar—and Other Essays on the English Vocabulary* (National Council of Teachers of English, Urbana, Illinois, 1989).

## **1. Emphasizes what was found, not who did the finding**

**“We determined that annealing the thin films at 700°C produced voids and increased surface roughness.”** (first person, active voice; **15** words)

**“Voids and increased surface roughness were observed in the thin films annealed at 700°C.”** (impersonal, passive voice; **14** words)

**Tip:** Make the important idea, observation, finding, or conclusion the *subject* of the sentence to make it stand out for the reader

In the first sentence, the key finding—increased voids and surface roughness—are buried as objects of the verbs of a dependent clause and marooned at the end of the sentence.

By recasting the sentence in the passive voice, we put the key finding front and center.

## 2. Presents findings in a neutral, objective, straightforward way

**“We found that increasing the pressure resulted in shear failures along grain boundaries.”**

(first person/active voice; **13** words)

**“Increasing the pressure resulted in shear failures along grain boundaries.”**

(impersonal/active voice; **10** words)

**“Shear failures along grain boundaries were observed as pressure increased.”**

(impersonal/passive voice; **10** words)

Consider the “authority” of the following statements:

The first sentence expresses the implicit, niggling possibility that although **you** obtained this result, somebody else might get different results. Or maybe you’re just mistaken in what you think you saw.

The second sentence, which removes the actor but maintains the active voice, may subtly imply more “proof” than warranted. Using the active voice puts the subject (increasing pressure) in the role of causing the object (shear failures along grain boundaries).

The third sentence, which is also more concise than the original active-voice sentence (10 words vs. 13), presents your result as a naturally occurring phenomenon, independent of who observed it. The passive voice, however, does not overstate the causality as the second sentence might.

The third sentence is also preferable, in my opinion, because it takes the important concept—shear failures along grain boundaries—out of a dependent clause (“that increasing the pressure...”) and makes it the subject of the sentence.

Always frontload key words.

**But Celia, the passive voice is always more awkward and wordy...**

**“We measured the ductility of the high-entropy alloys at both ambient and liquid-nitrogen temperatures.”**

(first person/active voice; 14 words)

**“The ductility of the high-entropy alloys was measured at both ambient and liquid-nitrogen temperatures.”**

(impersonal/passive voice; 14 words)

**“We used energy-resolved field-assisted photoemission in a Ag/InP Schottky diode to investigate hot-electron transport in InP.”**

(first person/active voice; 16 words)

**“Hot-electron transport in InP was investigated by energy-resolved field-assisted photoemission using a Ag/InP Schottky diode.”**

(impersonal/passive voice; 15 words)

**... oops**

**Here's a quiz question:**

**What percentage of the sentences in most journal articles are written in the passive voice?**

- a) <10 percent**
- b) ≈20 percent**
- c) ≈35 percent**
- d) >50 percent**

- a) <10 percent
- b) ≈20 percent**
- c) ≈35 percent
- d) >50 percent



**So is this whole debate a “tempest in a teacup”?**  
**Maybe, if it diverts us from what should be our primary focus—to share our results with the community in the clearest, most concise way we can**

*“This rule [use the active voice] does not, of course, mean that the writer should entirely discard the passive voice, which is frequently convenient and sometimes necessary.”*

W. Strunk Jr. and E.B. White, *The Elements of Style*, 4th ed. (New York, Longman, 2000), p. 18.

Based on three statistical studies undertaken by Merriam-Webster’s Dictionary of English Usage.



## But Celia, the passive voice allows authors to evade responsibility

PHYSICAL REVIEW

VOLUME 108, NUMBER 5

DECEMBER 1, 1957

### Theory of Superconductivity\*

J. BARDEEN, L. N. COOPER,<sup>†</sup> AND J. R. SCHRIEFFER<sup>‡</sup>  
 Department of Physics, University of Illinois, Urbana, Illinois  
 (Received July 8, 1957)

A theory of superconductivity is presented, based on the fact that the interaction between electrons resulting from virtual exchange of phonons is attractive when the energy difference one-to-one correspondence with those of the normal phase is obtained by specifying occupation of certain Bloch states and by using the rest to form a linear combination of virtual pair con-

*“An author’s central obligation is to present an accurate and complete account of the research performed, absolutely avoiding deception, including the data collected or used, as well as an objective discussion of the significance of the research...The research report and the data collected should contain sufficient detail and reference to public sources of information to permit a trained professional to reproduce the experimental observations.”*

American Chemical Society, *Ethical Guidelines to Publication of Chemical Research*,  
 May 2014. <http://pubs.acs.org/userimages/ContentEditor/1218054468605/ethics.pdf>

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## **Instead of agonizing over voice, consider what you want to emphasize**

- 1. “We used an SEM to examine surface defects in the GaAs thin films.” (AV)**
- 2. “An SEM was used to examine surface defects in the GaAs thin films.” (PV)**
- 3. “Surface defects in the GaAs thin films were examined using an SEM.” (PV)**
- 4. “Gallium-arsenide thin films were examined for surface defects using an SEM.” (PV)**

**Put the important stuff first—that’s where readers are paying the most attention**

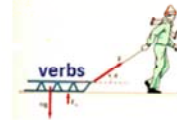
Use of the passive voice places the concept or observation that you want to emphasize at the beginning of the sentence, where readers pay the most attention. What you put in that first place depends on what you want to emphasize.

In these examples, if the paper reports the first use ever of an SEM for these types of studies, and that’s the most important point, use sentence 2.

If the main point of the paper is the study of surface defects, use sentence 3.

If this experiment is the first time anybody has looked at GaAs thin films for surface defects, and that’s the news, use sentence 4.

## To recap...



1. Use strong, active verbs
2. Use “is” sentences only to define or equate
3. Use the passive voice to emphasize what was found, not who did the finding
4. Avoid starting sentences with “There are...” or “It is...” —make the main idea the subject and plunge right in
5. Use past tense for what you did and present tense for time-independent facts
6. Write short (<25 words) sentences



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NOTES: