
Scientific Writing: Meeting Expectations of Your Readers



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Goals of this presentation



1. Examine effect of structure on meaning
2. Review three (3) important principles
3. Practice with examples

Why Bother?

“The journal *Nature* published an article complaining about the fact that most scientists were writing so that absolutely nobody could understand them,” Patterson said.

“The biggest problem is sentence structure. Most people think that vocabulary is the problem when you’re communicating science. The biggest problem is not putting things where a person expects to find them.”

From: **Spread the Word: Science Writing at National Labs**

Adam Smith <http://legacy.jyi.org/SCC/Article.php?articleNum=132>

(accessed 05142013) quoting Eileen Patterson, managing editor for 1663

[science and technology magazine at Los Alamos National Laboratory] ^{3 of 29}

Cognition and interpreting text: use structure carefully to limit ambiguity for readers.

that was being

- The horse[^]raced past the barn fell in a heap.

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that was being

- The raft[^] floated down the river sank.

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- While Mary was mending, the sock fell off her lap.

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that

- The cotton^clothing is made from grows in Mississippi.

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- The daughter of the king's son admires himself.

The king's grandson admires himself.

Cognition and interpreting text: Good scientific writers use structure carefully to limit ambiguity for readers

- D-pro2-endomorphin-1 and D-pro2-endomorphin-2, respectively, attenuate the antinociception induced by endomorphin-1 and endomorphin-2 given intrathecally in the mouse.

Reading is a two-pronged task



1. Finding the grammatical structure
2. Understanding the meaning

“Bad writing then could be defined as writing which forces the reader to spend a disproportionate amount of time on structure.”

1. Start with good topic sentences

Two easy revision strategies



- Applies generally to every other sentence in the paragraph.
 - If sentence does not relate to the topic sentence, use it to write a new paragraph.
 - Or, make the topic sentence more general to apply to all the ideas in the paragraph.

And don't forget appropriate functional transitions between sentences and between paragraphs

Use appropriate functional transitions between clauses, sentences, and paragraphs

Appropriate is defined by the logical relationships between these parts of text

Additive

and (weakest)
again
also,
besides
equally important,
further,
furthermore,
in addition,
moreover

Contrast

but
however
although
and yet,
at the same time,
but at the same
time,
despite the fact that,
in contrast,
in spite of

Consequence

, causing ...
As a result,
In consequence
, resulting in ...

Use appropriate functional transitions between clauses, sentences, and paragraphs

Chronology

before, after, during, then
next
last

Referring Expressions

...certain factors. **These** factors are significant because ...

...first described by Nair et al.
The authors approach ...

The basic mechanism behind atmospheric impacts of land cover change ...[something about several features]. The relative importance of these features ...

1. Start with good topic sentences

With a laser frequency set to the resonance of an atom, the atom can absorb and reradiate millions of photons each second, with each photon giving the atom a small push. In order to cool the atoms in the glass box, the authors detuned the lasers to a frequency slightly below resonance. As a result, only atoms that move with some velocity absorb atoms because these atoms see the laser at a higher frequency, the resonant frequency, due to a Doppler shift from their velocity. All atoms that are not moving do not see the laser with a Doppler shift and therefore see the laser at an off-resonant frequency, making the atoms practically invisible to the laser. The glass box in Cornell and Weiman's experiment employed six detuned lasers converging on the box, so that the moving rubidium atoms were slowed down and the stationary atoms were not sped up. In this manner, the rubidium atoms slowed down, causing them to cool.

Topic sentences serve important functions by pointing back to previous text and forward to what's coming up next



- Connects paragraph to preceding ideas – pointing backward
- Tells readers what the paragraph is about – pointing forward
- Structural techniques:
 - Repeat final word or phrase of preceding paragraph
 - Refer back to an idea presented earlier and relate that to new paragraph
 - Both techniques can include transitional word/phrase

2. All sentences should maintain the focus of the story



- Help readers determine what each sentence and paragraph are about.
- Use the *focus of the story* as the grammatical subject or in the *topic* position of sentences whenever possible.
- Use consistent terminology.

2. All sentences should maintain the focus of the story

Source: “The Sun and the Interstellar Medium” (Paresce and Bowyer, 1986).

This flowing wind of neutral species through the solar system is due to the motion of the sun through the local interstellar medium (ISM). The authors indicate that the local ISM is a partially-ionized plasma with a velocity of about 24 km/s with respect to the sun's rest frame. The flow originates from the direction of Centaurus and is directed toward Cassiopeia.

Hydrogen and helium absorption cells were used in the late 1970's to measure the Ly α and neutral helium line profiles to infer the temperature of the plasma, about 15,000 degrees Kelvin.

The authors further suggest that this flow originated from strong winds from hot young stars or supernova shock waves originating in the Scorpius-Centaurus association of young stars—located about 500 light years away from Earth.

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3. Old information and transitions expected in 'start' position



- Situate contextual (old) information on the 'left,' at the beginning of sentences and at beginning of paragraphs
- Relate new idea to what has come before
- Provide functional transitions for readers



New Information expected in 'stress' position

- Readers emphasize material at the end of a sentence.
- Place the new, important information on the 'right', at the end of the sentence.
- A sentence is overloaded if there are too many candidate ideas for the stress position.
- This opposes the linear thinking style of many writers.



Before discussing the inner workings of a refrigerator, it is useful to understand a few simple physics concepts. The first of these is the boiling point of a liquid. The boiling point is the temperature at which a liquid will boil. For example, the boiling point for water is 212 degrees Fahrenheit at sea level. Water's boiling point is lower at higher elevations. **Marshall Brain (1998) provides a simple experiment** for understanding the properties of boiling points. First place a pot of water on a stove
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Complexity is the norm for scientific writing

- The more complex the topic, the more we need functional transitions
 - State old information first, at beginning of sentence
 - This kind of strategic, reader-friendly repetition can be OK

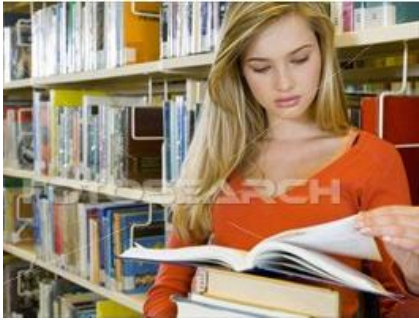
A few key obstacles stand in the way of achieving thermonuclear ignition at the National Ignition Facility (NIF). Controlling parametric instabilities, especially Stimulated Raman Scattering (SRS) is one of them. The light wave decays into a scattered light wave and an electrostatic plasma wave (EPW). Laser power coupling into the target can be spoiled by parametric instabilities and can accelerate electrons, which preheat the target. The linear-theory thresholds for significant SRS activity are routinely exceeded in experiments on ignition-relevant quasi-homogeneous plasmas. It is clear from experimental results from existing lasers that SRS saturates via non-linear processes. Coupling of energy from the SRS daughter EPW to other non-resonant EPWs is one possible saturation mechanism for SRS [Baker et al., Phys. Rev. Lett. 77 (1996) 67].

Why it is hard to follow: [Location of old information](#)

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Edit text with your reader in mind



1. Topic sentence of paragraph
2. Maintain a clear 'owner' of story for each sentence & paragraph
3. Follow expected Old/New - Topic/Emphasis sentence structure with appropriate transitions

References and Graphics Credits

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Graphics Credits

- Expectations <http://bit.ly/GoRKq>
- Two-prongs <http://bit.ly/twopronged>
- Two fingers <http://bit.ly/FHdom>
- Arrows <http://bit.ly/1uzcmY>
- Focus <http://bit.ly/zjYOz>
- Old <http://bit.ly/Khr1t>
- New <http://bit.ly/1sMtU0>
- Cars following closely <http://bit.ly/eYqqS0>
- Action! <http://bit.ly/6KGn1>
- Ball of string <http://bit.ly/aFzzw>