



# Research Methods in CS

Cohesion, Coherence, and Emphasis  
in Scientific Writing

## Coherence, Cohesion, and Emphasis

### Principles:

1. Put new information last (cohesion)
2. Use passive voice judiciously
3. Make sure the first and last sentences of a paragraph match (coherence)

### Acknowledgement:

- I based these slides mostly on Duke University Graduate School Scientific Writing Resource at <https://cgi.duke.edu/web/sciwriting> (Coherence, Cohesion, and Emphasis), but I changed several examples to use computing concepts and terminology.

## Principle 1: Put new information last

### Begin sentences with familiar (old) information

- establish context by linking to previous sentences
- avoid confusion requiring multiple readings
- make the writing cohesive (sentences stick together)

### Conclude sentences with unfamiliar (new) information

- introduce new ideas or characters in context
- seek clarity
- emphasize new information at end

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## Put new information last

### Example

*Farmers try to provide optimal growing conditions for crops by using soil additives to adjust soil pH. Garden lime, or agricultural limestone, is made from pulverized chalk, and can be used to raise the pH of the soil. Clay soil, which is naturally acidic, often requires addition of agricultural lime.*

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## Put new information last

Example annotated with old and new:

*Farmers try to provide optimal growing conditions for crops by using soil additives to adjust soil pH.*

*Garden lime, or agricultural limestone, is made from pulverized chalk, and can be used to raise the pH of the soil.*

*Clay soil, which is naturally acidic, often requires addition of agricultural lime.*

- Sentence 2 introduces "garden lime" with little context: lime as citrus fruit? or as soil additive
- Sentence 3 introduces "clay soil" with little context: itself an additive? or needing additive?

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## Put new information last

Original:

*Farmers try to provide optimal growing conditions for crops by using soil additives to adjust soil pH. Garden lime, or agricultural limestone, is made from pulverized chalk, and can be used to raise the pH of the soil. Clay soil, which is naturally acidic, often requires addition of agricultural lime.*

Rewrite:

*Farmers try to provide optimal growing conditions for crops by using soil additives to adjust soil pH. One way to raise the pH of the soil is an additive made from pulverized chalk called garden lime or agricultural limestone. Agricultural limestone is often added to naturally acidic soils, such as clay soil.*

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## Put new information last

### Rewrite:

*Farmers try to provide optimal growing conditions for crops by using soil additives to adjust soil pH.*

*One way to raise the pH of the soil is an additive made from pulverized chalk called garden lime or agricultural limestone.*

*Agricultural limestone is often added to naturally acidic soils, such as clay soil.*

- Each sentence “leans forward” from old to new information
- Paragraph becomes more cohesive
- New information emphasized

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## Put new information last

### Revision technique:

**Read through your manuscript carefully. In each sentence, underline any pieces of new information (unfamiliar to the reader at this point in the manuscript). Make sure your sentences begin with an appropriate backwards link, and not with an unfamiliar concept.**

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## Principle 2: Use passive voice judiciously

### Active voice sentence:

Subject Verb Object

Subject Verb

Subject is actor, Verb is action, Object is acted upon

### Passive voice sentence:

Object Verb Subject

Object Verb

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## Use passive voice judiciously

### Active:

*The payroll program prints the paychecks twice a month.*

subject = program, verb = prints, object = paychecks

### Passive:

*The paychecks are printed by the payroll program twice a month.*

switches positions of subject and object

*The paychecks are printed twice a month.*

leaves out subject (actor) entirely

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## Use passive voice judiciously

Passive voice is grammatically correct and often useful but used excessively in scientific writing

Misconceptions:

- ✗ Passive voice is inherently scientific
- ✗ Passive voice is more objective
- ✗ Writers should avoid first person pronouns

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## Use passive voice judiciously

Using first-person pronouns?

- Active voice livelier, easier to read
- Myth that avoiding first-person gives more objectivity
  - You did the work—to imply otherwise is misleading
  - Results did not magically appear
- All authors must take responsibility for paper's content

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## Use passive voice judiciously

(A) Problem with passive voice – actor is often ambiguous

- Common to leave out actor in scientific writing (i.e., Object Verb)
- Can lead to confusion if difficult to determine actor
- Acceptable when actor is self-explanatory, understood, or unimportant – e.g., when describing methods

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## Use passive voice judiciously

Example of ambiguous actor (from Zobel textbook, p. 14):

*The following theorem can now be proved.*

Rewrite:

*We can now prove the following theorem.*

Direct (active) style is less stilted, easier to read

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## Use passive voice judiciously

Example of ambiguous actor:

*The web application was designed using the Model-View-Controller (MVC) architectural pattern (Reenskaug et al 2009).*

Who designed the application? Was it Reenskaug et al? Or did they develop MVC?

Rewrites?

*The team designed the web application using the Model-View-Controller architectural pattern (Reenskaug et al 2009).*

*The team used the Model-View Controller architectural pattern (Reenskaug et al 2009) to design the web application.*

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## Use passive voice judiciously

(B) Problem with passive voice – dangling modifiers

**Dangling modifier: modifying phrase whose implicit subject does not match explicit subject of sentence**

- Considered grammatical error in modern English usage
- Occurs frequently in scientific writing, almost accepted
- Confuses reader, so avoid it

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## Use passive voice judiciously

Example of dangling modifier:

*Using the Strategy design pattern, the specific sorting algorithm can be selected at runtime.*

- “Using the Strategy design pattern” has implied subject “the programmers”.
- But the implicit subject of passive sentence is “the program” or maybe “the users”

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## Use passive voice judiciously

Original:

*Using the Strategy design pattern, the specific sorting algorithm can be selected at runtime.*

Rewrites?

*Using the Strategy design pattern, the programmers designed the program to select the specific sorting algorithm at runtime.*

*Using the Strategy design pattern, the programmers designed the program to enable users to select the specific sorting algorithm at runtime.*

*The programmers used the Strategy design pattern in the program design. This enabled the users to select the specific sorting algorithm at runtime.*

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## Use passive voice judiciously

### (C) Problem with passive voice – wordiness

- If everything else is equal, shorter writing is better than longer
- Readers benefit if they have less to read to get same information
- Passive voice tends to increase length slightly

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## Use passive voice judiciously

### Example (Zobel, p. 14):

*Tree structures can be utilized for dynamic storage of terms.*

Implicit actor, weak verb “utilized”, concept noun “storage”, 10 words

### Rewrites:

*Terms can be stored in dynamic tree structures.*

Still passive, more precise verb “stored”, 7 words

*The program stored terms in dynamic tree structures.*

Explicit actor in subject, 8 words

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## **Use passive voice judiciously**

### **Advantage of passive voice:**

**Changes order of sentence, so can help put old information before new**

### **Revision technique:**

**When you revise for new/old information placement, use active/passive switching to keep the placement of information consistent with expected structure.**

**But be careful with ambiguity, providing actors to avoid confusion**

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## **Principle 3: Make sure first & last sentences of paragraph match**

### **Coherence:**

- **Readers expect thoughts expressed in paragraph units**
- **Paragraphs correspond to single thought**
- **Each sentence supports that thought**
- **Along with cohesion, maintains logical flow**

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## Make sure first & last sentences of paragraph match

Example of paragraph that is cohesive, but not coherent

*My favorite animal is the domestic cat. Cats were domesticated almost 10,000 years ago in ancient Mesopotamia. Mesopotamia is a name that literally means "the land between two rivers," taken from Greek. The Greek language is one of the oldest written languages, and its alphabet forms the basis of many other writing systems, including Latin. Latin ...*

Topic wanders from cats to Mesopotamia to the Greek language to the Latin language, etc. Not coherent!

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## Make sure first & last sentences of paragraph match

Revision technique

**Test for coherence: Read the first and last parts of each paragraph. Do the topics match? To be more thorough, make sure each sentence in a paragraph supports the main point of that paragraph.**

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## Example 1

*Detecting security vulnerabilities at the code level has been a subject of considerable interest.*

Readers naturally emphasize end of sentences.

What do we want to emphasize? Probably either "security vulnerabilities" or "code level" -- depending on the point of the paper.

Rewrite to emphasize the code level:

*One subject of considerable interest has been detecting security vulnerabilities at the code level.*

Rewrite to emphasize security vulnerabilities:

*One subject of considerable interest at the code level has been detecting security vulnerabilities.*

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## Example 2

*Improvements are expected in the predictive power of all the scores being computed on the clickstreams.*

Has two passive-like verbs: are expected, being computed

Eliminating those, turning "improvement" into verb, yields revision

*Our method will improve the predictive power of all clickstream scores.*

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## Example 3

*A survey is given of differential expression analyses using the linear modeling features of the package.*

Relies on passive voice, leading to awkwardness

“a survey is given of” is difficult to parse

Does “using” modify survey or analyses?

Rewrites?

*We use the linear modeling features of the package to survey differential expression analyses.*

*We survey differential expression analyses that use the linear modeling features of the package.*

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## Example 4

*By typing alphabetic characters in the text box, the Web application was demonstrated to charge the customer's credit card incorrectly.*

Relies on passive voice with unspecified actor

Has a dangling modifier

Rewrite eliminating passive in the main clause:

*By typing alphabetic characters in the text box, the test team showed that the Web application incorrectly charged the customer's credit card.*

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## Example 5

*Science is a system for accumulating reliable knowledge. Speculation, observation, and a growing understanding of some idea or phenomenon, broadly speaking, begin the process of science.*

(constructed from passage in Zobel textbook, p. 3)

Second sentence

- begins with new information "speculation, ..."
- has old information "process of science" later
- complex subject, separated from verb

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## Example 5

*Science is a system for accumulating reliable knowledge. Speculation, observation, and a growing understanding of some idea or phenomenon, broadly speaking, begin the process of science.*

Simplify the subject, decrease subject-verb distance, put new information last:

*Science is a system for accumulating reliable knowledge. Broadly speaking, the process of science begins with speculation, observation, and a growing understanding of some idea or phenomenon.*

Second sentence now has

- backwards link to the previous sentence (old info.)
- less complex subject
- reduced subject-verb distance

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