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Writing for Computer Science

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The Mechanics of Writing

Why is Writing Difficult?

1. curse of knowledge:

- once one understands something, the earlier state of mind (ignorance) is forgotten
- it becomes inconceivable how anyone could *not* understand

2. linearity:

- the brain works in an associative fashion (like a graph structure of ideas/concepts and their relationships)
- writing is linear (with some recursive elements)

- based on: “Style: Toward Clarity and Grace”, Williams, 1990, University of Chicago Press

The Mechanics of Writing

Clarity

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(1b) “Because we knew nothing about local conditions, we could not determine how effectively the committee had allocated funds to areas that most needed assistance.” ✔

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problems with (1a) and (2a):

- abstract nouns (decisions, administration, medication, inability, consent)
- unclear who does what

- human brains are built for stories, not for abstractions
- a story consists of *characters* performing *actions*
- think of movies, theater plays
- in Computer Science, we usually write about abstract concepts, but as long as we write *for* humans, we have to adapt to them
- *good writing is storytelling*

Characters and Actions

(3a) “Though the Governor knew that cities needed new revenues to improve schools, he vetoed the budget bill because he wanted to encourage cities to increase local taxes.” ✓

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- cities: need revenues, should improve schools, increase taxes
- schools: will be improved

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- cities: need revenues, should improve schools, increase taxes
- schools: will be improved

“Despite his knowledge of the need by cities for new revenues for the improvement of their schools, the Governor executed a veto of the budget bill to give encouragement to the cities for an increase of local taxes.” ✗

Two Principles of Clear Writing

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2. the *verbs* that go with those subjects should name crucial actions those characters are part of

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“Because **we** *knew nothing* about local conditions, *we could not determine* how effectively the **committee** *had allocated* funds to areas that most needed assistance.” ✓

“Our **lack of knowledge** about local conditions *precluded* determination of committee action effectiveness in fund allocation to those areas in greatest need of assistance.” ✗

Some Consequences (1)

- writing becomes more specific and concrete:
“There has been an affirmative decision for program termination.” ✗
“The Director decided to terminate the program.” ✓
- fewer prepositions:
“An evaluation of the program by us will allow greater efficiency in service to clients.” ✗
“We will evaluate the program so that we can serve clients better.” ✓
- shorter sentences

Some Consequences (2)

- logical (chronological) order:

“The closure of the branch and the transfer of its business and non-unionized employees constituted an unfair labor practice because the purpose of obtaining an economic benefit by means of discouraging unionization motivated the closure and transfer.” ✘

“The partners committed an unfair labor practice when they closed the branch and transferred its business and nonunionized employees in order to discourage unionization and thereby obtain an economic benefit.” ✓

- logical relationships are clarified (e.g., because, although):

“The more effective presentation of needs by other Agencies resulted in our failure in acquiring federal funds, despite intensive lobbying efforts on our part.” ✘

“Although we lobbied Congress intensively, we could not acquire federal funds because other interests presented their needs more effectively.” ✓

Kinds of Characters

- agents: “*Mayor Daley* build Chicago into a giant among cities.”
- figurative agents: “*The White House* announced today the President’s schedule.”
- things that are means to something: “*Studies* of coal production reveal these figures.”

Hidden Characters

“In the last sentence of the Gettysburg Address there is a rallying cry for the continuation of the struggle.” ✘

“In the last sentence of the Gettysburg Address, Lincoln rallied his audience to continue the struggle against the South.” ✔

“Determination of policy occurs at the presidential level.” ✘

“The President determines policy.” ✔

think of a theater play: Who is the main protagonist, what are other roles?

Nominalization (Hidden Actions)

hidden verbs:

- discovery → discover
- movement → move
- resistance → resist
- (the) hope → (to) hope

hidden adjectives:

1. carelessness → careless
2. difficulty → difficult

“Our request is that on your return, you conduct a review of the data and provide immediate report.” ✘

“We request that when you return, you review the data and report immediately.” ✔

There are Good Use Cases for Nominalization

1. referring to previous sentence:

"These arguments all depend on a single unproven claim." ✓

2. nominalization as grammatical object:

"I do not understand either her meaning or his intention." ✓

"I do not understand either what she means or what he intends." ✗

3. replacement for the fact that:

"The fact that I denied what he accused me of impressed the jury." ✗

"My denial of his accusations impressed the jury." ✓

4. refer to repeated concept (abstractions become characters):

"The Equal Rights Amendment was an issue in past elections." ✓

Summary

- strong characters and their actions are crucial for clarity
- should be mapped to grammatical subjects and verbs

subject	verb	complement	fixed (grammar)
character	action	-	variable (story)

The Mechanics of Writing

Cohesion

Example

(4a) “Asian competitors who have sought to compete directly with Acme’s X-line product groups in each of six market segments in the Western Pacific region will constitute the main objective of the first phase of this study. The labor costs of Acme’s competitors and their ability to introduce new products quickly define the issue we will examine in detail in each segment. A plan that will show Acme how to restructure its diverse and widespread facilities so that it can better exploit unexpected opportunities, particularly in the market on the Pacific Rim, should result.”

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- no issues with nominalization
- characters and actions are fine
- but somehow there is a lack of flow

Example (2)

(4b) “The first phase of this study will mainly examine six market segments in the Western Pacific region to determine how Asian competitors have sought to compete directly with Acme’s X-line product groups. In each segment, the study will examine in detail their labor costs and their ability to introduce new products quickly. The result will be a plan that will show Acme how to restructure its diverse and widespread facilities so that it can better exploit unexpected opportunities, particularly in the market on the Pacific Rim.”

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it important to find a good compromise between

1. principles of local clarity within a sentence and
2. principles of cohesion between sentences

Managing the Flow of Information: Active vs. Passive Voice

- (a) “A black hole is created by the collapse of a dead star into a point perhaps no larger than a marble.”
- (b) “The collapse of a dead star into a point perhaps no larger than a marble creates a black hole.”

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first sentence introduces the “black hole” concept, starting the next sentence with “black hole” would tightly connect both sentences

Two Complementary Principles of Cohesion

1. Put at the beginning of a sentence those ideas that you have already mentioned, referred to, or implied, or concepts that you can reasonably assume your reader is already familiar with, and will readily recognize.
2. Put at the end of your sentence the newest, the most surprising, the most significant information: information that you want to stress – perhaps the information that you will expand on in your next sentence.

Beginning a Sentence

More difficult than ending, one has to do several things at once:

1. transitional metadiscourse: “and”, “but”, “therefore”, “as a result”
2. help reader evaluate what follows: “fortunately”, “it is important to note”, “practically speaking”
3. locate time and place: “then”, “later”, “on May 23”, “in Europe”
4. **topic** (most important): concept that we intend to say something about, usually grammatical subject

“And therefore, it is important to note, that from a practical point of view, in the Northeastern states in recent years, these sources of acid rain have been a matter of much concern...”

Topic: *Psychological Subject*

- topic/concept on which writer will comment on
- usually noun phrase in first few words of a sentence
 - often as grammatical subject:
“**Private higher education** is seriously concerned about population trends through the end of the century.”
 - but also as introductory phrase:
“As for **taxes**, it is not clear how the Supreme Court will rule.”
- In clear writing, the topics of most sentences and clauses are their grammatical subjects.
- But it is even more important how topics control how readers read sequences of sentences

- the first couple of words in a sentence are crucial: locate reader in familiar territory
- across sentences one should choose a consistent topic string
- changing topics abruptly or too often makes it hard to follow the text
- long sentences can be hard to understand, because they do not announce topic often enough

topic		
old information		new information
subject	verb	-
character	action	-

- reduce metadiscourse
- consider passive (see earlier example)
- switch subject/complement:
“Some complex issues run through these questions.”
“Through these questions run some complex issues.”

Two Principles

1. Put in the subject/topic of your sentences ideas that you have already mentioned, or ideas that are so familiar to your reader that if you state them at the beginning of a sentence, you will not surprise anyone.
2. Among groups of related sentences, keep their topics consistent, if you can. They don't have to be identical, but they should constitute a string that your readers will take to be focused.

Consequences

- passive sentences can help keep consistent string of topics
- nominalization may be useful to refer to earlier ideas:
“To account for the relationships among colonies of related samples, it is necessary to track their genetic history through hundreds of generations. This kind of study requires a careful history of a colony.”
- can gradually change topics in paragraph (as long as reader can follow logical connection)
- new section/paragraph often introduces new topic

Summary

- start sentences with something already mentioned or knowledge the reader already knows
- use topics to control reader's point of view

topic		
old information		new information
subject	verb	-
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The Mechanics of Writing

Emphasis

“A charge of gross violation of academic responsibility is required for a Board of Trustees to dismiss a tenured faculty member for cause, and an elaborate hearing procedure with a prior statement of charges is provided for before a tenured faculty member may be dismissed for cause, in most States.”

Emphasis (1)

“A charge of gross violation of academic responsibility is required for a Board of Trustees to dismiss a tenured faculty member for cause, and an elaborate hearing procedure with a prior statement of charges is provided for before a tenured faculty member may be dismissed for cause, in most States.” ✘

“In most States, before a Board of Trustees may dismiss a tenured faculty member for cause, it must charge him with a gross violation of academic responsibility and provide him with a statement of charges and an elaborate hearing procedure.” ✔

“That a single man in possession of a good fortune must be in want of a wife, is a truth universally acknowledged.”

“That a single man in possession of a good fortune must be in want of a wife, is a truth universally acknowledged.” ✘

“It is a truth universally acknowledged, that a single man in possession of a good fortune, must be in want of a wife.” ✔

- the end of the sentence is called *stress*
- it is the position of emphasis
- new or surprising or important information should go there

Exploiting the Stress Position

- trim the end:
“Sociobiologists are making the provocative claim that our genes largely determine our social behavior ~~in the way we act in situations we find around us every day.~~”
- shift less important information to the left:
“The data that are offered to establish the existence of ESP do not make believers of us for the most part.” ✗
“For the most part, the data that are offered to establish the existence of ESP do not make us believers.” ✓
- shift important information to the right:
“Those questions relating to the ideal system for providing instruction in home computers are just as confused.” ✗
“Just as confused are those questions relating to the ideal system for providing instruction in home computers.” ✓

Exploiting the Stress Position (2)

- when you put your most important ideas in the middle of a long sentence, the sentence will swallow them up
- breaking up the sentence may help

“Under the Clean Water Act, the EPA will promulgate new standards for the treatment of industrial wastewater prior to its discharge into sewers leading to publicly owned treatment plants, with pretreatment standards for types of industrial sources being discretionary, pending on local conditions, instead of imposing nationally uniform standards now required under the Act.” ✗

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“Under the Clean Water Act, the EPA will promulgate new standards for the treatment of industrial wastewater before it is discharged into sewers leading to publicly owned treatment plants. Unlike the standards now required under the act, the new standards will not be uniform across the whole nation. They instead will be discretionary, depending on local conditions.” ✓

Syntactic Devices to Add Weight to the End of Sentence

- there are: “There are a few grammatical patterns that add weight to the end of a sentence.”
- what: “What this country needs is a monetary policy that will end the violent fluctuations in money supply, unemployment, and inflation.”
- it-shift 1:
 - “That domestic oil prices must eventually rise to the level set by OPEC once seemed inevitable.” ✗
 - “It once seemed inevitable that domestic oil prices must eventually rise to the level set by OPEC.” ✓
- it-shift 2:
 - “In 1933 this country experienced a depression that almost wrecked our democratic system of government.” ✗
 - “It was in 1933 that this country experienced a depression that almost wrecked our democratic system of government.” ✓

Summary

- the end of a sentence, the stress position, is the best place to put new, important information that should be emphasized

topic		stress	
old information		new information	
subject	verb	complement	
character	action	-	

The Mechanics of Writing

Coherence

Principles of Coherence Beyond Sentences

1. A cohesive paragraph has consistent topic strings.
2. A cohesive paragraph has another set of strings running through it that we will call thematic strings.
3. A cohesive paragraph introduces new topic and thematic strings in a predictable location: at the end of the sentence(s) that introduce the paragraph.
4. A coherent paragraph will usually have a single sentence that clearly articulates its point.
5. A coherent paragraph will typically locate that point sentence in one of two places.

Coherence Principle 1: Consistent Topic Strings

- stories have more than one character, which are often abstractions
- we have to choose our topics that focus the reader's attention to a particular point of view

“Clark’s practice of carefully mapping every fossil made it possible to follow the evolutionary development of various types through time. Beautiful sequences of antelopes, giraffes and elephants were obtained; new species evolving out of old and appearing in younger strata. In short, evolution was taking place before the eyes of the Omo surveyors, and they could time it. The finest examples of this process were in several lines of pigs which had been common at Omo and had developed rapidly. Unsnarling the pig story was turned over to paleontologist Basil Cooke. He produced family trees for pigs whose various types were so accurately dated that pigs themselves became measuring sticks that could be applied to fossils of questionable age in other places that had similar pigs.”

Coherence Principle 2: Thematic Strings

“Truman had many issues to factor into his decision about the Oppenheimer committee’s scientific recommendation to stop the hydrogen bomb project. A Sino-Soviet bloc had been proclaimed; the Cold War was developing; Republican leaders were withdrawing support for his foreign policy; and opinion was coming down on the side of a strong response to the first Russian atom bomb test. As a Democratic President, Truman concluded that being second in developing the hydrogen bomb was an alternative he could not risk. In retrospect, some now believe that the risk was worth taking, but they did not have to consider the issues that Truman did.”

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- depending on how much about 20th century political history you know, this may actually be clear
- but reader usually know less than you, the writer, so you need to help them

Coherence Principle 2: Thematic Strings (2)

“When the Oppenheimer committee advised President Truman to stop the hydrogen bomb project, Truman had to consider not just scientific issues, but also how *developing tensions between the U.S. and the USSR* were influencing *domestic politics*. When the Russians and Chinese proclaimed a hostile Sino-Soviet bloc, the Cold War became a political issue. At the same time, Truman was losing Republican support for his foreign policy. So when Russia set off its first atomic bomb, Americans demanded that their President respond strongly. He decided that he could not risk voters’ seeing him as letting the Russians be first in developing the most powerful weapon yet. Some critics now believe that he should have taken that risk, but they did not have to worry about Cold War American politics.” ✓

Introduction of New Topics And Thematic Strings

- Coherence Principle 3: A reader will feel that a paragraph is cohesive if he is introduced to new topic and thematic strings in a predictable location: at the end of the sentence(s) that constitute the opening section of a paragraph, section, or whole document.

“Clark’s practice of carefully mapping every fossil made it possible to follow the evolutionary development of various types through time.”

“Clark made it possible to follow the evolutionary development of various types through time because he mapped every fossil carefully.”

“Because Clark mapped every fossil carefully, it was possible to follow through time the evolutionary development of several species of pigs.”

“It became possible to follow through time the evolutionary development of several species of pigs because the careful mapping of every fossil had been done by Clark.”

- topics and thematic strings are not always introduced in the first sentence
- introductory segment is often more complex
 1. issue: short opening statement, 1/2/3 sentences/paragraphs
 2. discussion: rest of paragraph, longer than issue

issue	discussion	
-	-	
topic	stress	
old/familiar	new/unfamiliar	
subject	verb	complement
character	action	-

What's The Point?

- Coherence Principle 4: A reader will feel that a paragraph is coherent if she can read a sentence that specifically articulates its point.
- Coherence Principle 5: A reader will feel that a paragraph is coherent if he finds the POINT sentence in one of two predictable places in a paragraph: (1) at the end of its issue, or (2) at the end of its discussion; i.e., at the end of the paragraph (or section or whole document).

“Our main concern was to empirically test the theory that forms the background for this work. To a great extent, we have succeeded in showing our theory is valid. Chapter Two reports a study which shows that the rate of perceiving variations in length relates directly to the number of connectives in the base structure of the text. In chapter Three, we report a study that found that subjects perceive as variable units only what the theory claims is a unit. Another series of crucial studies is the comparison and contrast experiments reported in Chapter Three, which show that we do not distinguish complex concepts of different lengths as some current theories do.”

issue	discussion	
point	(point)	
topic	stress	
old/familiar	new/unfamiliar	
subject	verb	complement
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The Mechanics of Writing

Concision

“The point I want to make here is that we can see that American policy in regard to foreign countries as the State Department in Washington and the White House have put it together and made it public to the world has given material and moral support to too many foreign factions in other countries that have controlled power and have then had to give up the power to other factions that have defeated them.”

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“Our foreign policy has backed too many losers.” ✓

Two Principles of Concision

1. Usually, compress what you mean into the fewest words.
2. Don't state what your reader can easily infer.

Concision: Example

“In my personal opinion, we must listen to and think over in a punctilious manner each and every suggestion that is offered to us.” ✘

- opinions are always personal
- any statement is implicitly an opinion
- “listen to and think over” means “consider”
- “in a punctilious manner” means “carefully”
- “each and every” is redundant
- a “suggestion” is always offered to someone

“We must consider each suggestion carefully.” ✔

Simple Sources of Wordiness

- redundant pairs: “full and complete”, “true and accurate”
- redundant modifiers: “completely finish”, “past memories”
- redundant categories:
 - “The holes must be aligned in an accurate manner.” ✗
 - “The holes must be accurately aligned.” ✓
- meaningless modifiers:
 - “For all intents and purposes, American industrial productivity generally depends on certain factors that are really more psychological in kind than of any given technological aspect.” ✗
 - “American industrial productivity depends more on psychology than on technology.” ✓

- belaboring the obvious:
 - “Imagine a picture of someone engaged in the activity of trying to learn the rules for playing the game of chess.” ✗
 - “Imagine someone trying to learn the rules of chess.” ✓
- excessive detail (depends on reader expectation)

Common Wordy Phrases

- the reason for, due to the fact that, this is → because, since, why
- despite the fact that, regardless of the fact that → although, even though
- in the event that → if
- on the occasion of → when
- it is crucial that → must, should
- is able to → can
- it is possible that → may, might, can, could
- prior to → before
- does not have → lacks

Negatives Are Harder to Understand

- not many → few
- did not stay → left
- did not → failed to