

Why am I here?

- Nine lectures / workshops on **Scientific Writing**
- One lecture / workshop on **Oral Presentations**
- **One-on-one** help during office hours
 - Please leave plenty of **lead time** before your due dates

Meeting 1

Basic Scientific Communication



We are all apprentices of a craft where no one ever becomes a master.

Ernest Hemingway

Scientific Writing and Speaking



- Who likes it?
- Who hates it?
- Who's good at it?
- Who's bad at it?



Some Good Resources

- Alley, Michael. *The Craft of Scientific Writing*. 3rd ed. New York, NY: Springer, 1996. ISBN: 0387947663.
- Day, Robert A. *How to Write and Publish a Scientific Paper*. 5th ed. Phoenix, AZ: Oryx, 1998. ISBN: 1573561657.

Good MIT Resources

- Paradis, James G. and Muriel L. Zimmerman. *The MIT Guide to Science and Engineering Communication*. 2nd ed. Cambridge, MA: MIT Press, 2002. ISBN: 0262661276.
- <http://web.mit.edu/writing/temp2/home.htm>: an online hypertext version of Perelman, Leslie C., James Paradis, and Edward Barrett. *The Mayfield Handbook of Technical and Scientific Writing*. Mountain View, CA: Mayfield Publishing, 1998. ISBN: 1559346477.

What is the Purpose of Scientific Communication?

- **Inform:** Communicate the most information with least reading time.
- **Persuade:** Present logical arguments in a convincing manner.

What are the Constraints on Scientific Communication?

- **Audience:**
 - Who, What, Why, How
- **Format:**
 - Formats vary
- **Mechanics:**
 - Frustrating because of many inconsistent rules and lots of gray areas.
- **Politics:**
 - Try to remain honest

The Writing Process: Step 1



READ
THINK
TALK

- Do this to develop a **clear idea of your thesis**...
- ...and to develop a **strategy** for your writing.
- **Clear writing** is impossible in the absence of **clear thinking**.

The Writing Process: Step 2

DEVELOP AN OUTLINE

An outline is an overview...

...it can help you:

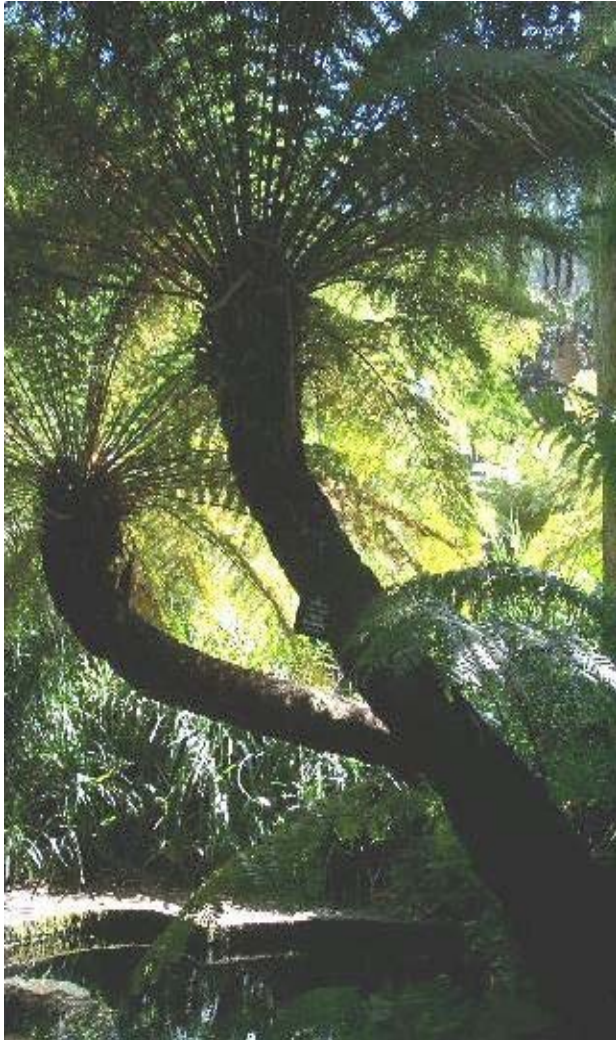
- **Isolate topics** (use keywords)
- **Partition** topics into **subcategories**
- **Sequence** topics
- **Identify gaps**
- **Eliminate unnecessary content**
- **Get feedback**



These activities are accomplished more efficiently with an outline than with a draft.

The Writing Process: Step 3

WRITE



- Fill in the **content** of your outline in any order you like.
- Make sure you **state your thesis** in the introductory paragraph.
- Be sure to use **topic sentences** in each paragraph.
- Make all **sentences** within a paragraph **pertain to the topic sentence**.
- Make intelligent **transitions** between paragraphs.

Photo courtesy of Dr. William Calvin (<http://www.williamcalvin.com/index.html>).

Used with permission.

The Writing Process: Step 4

REVISE REVISE **REVISE**

- Reread and revise **on your own.**
- Revise on the basis of feedback **from your peers.**
- Revise on the basis of feedback **from me.**
- Revise on the basis of feedback **from Drs. Sabatini and Burge.**



Photo courtesy of Dr. William Calvin (<http://www.williamcalvin.com/index.html>).

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Three Aspects of Writing Style

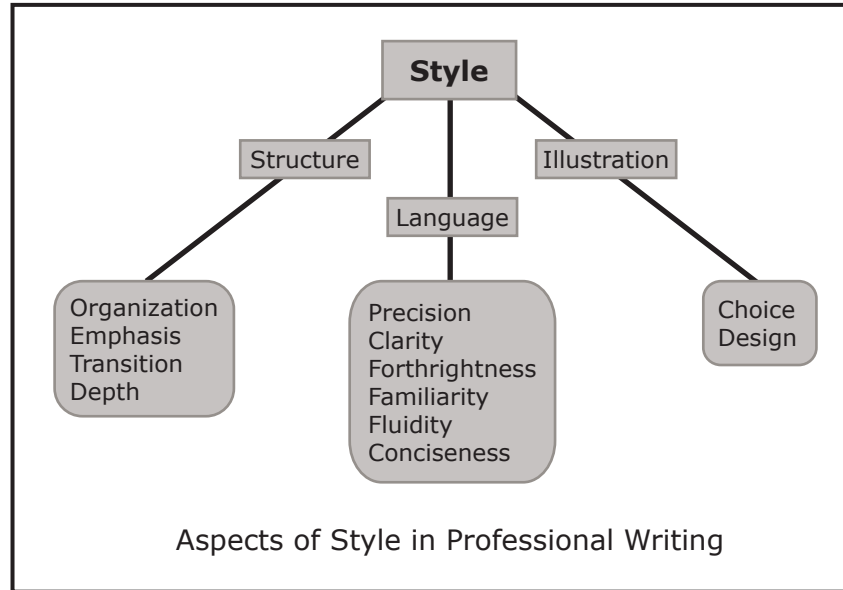


Figure by MIT OCW.

What We Look For in Structure (checklist)

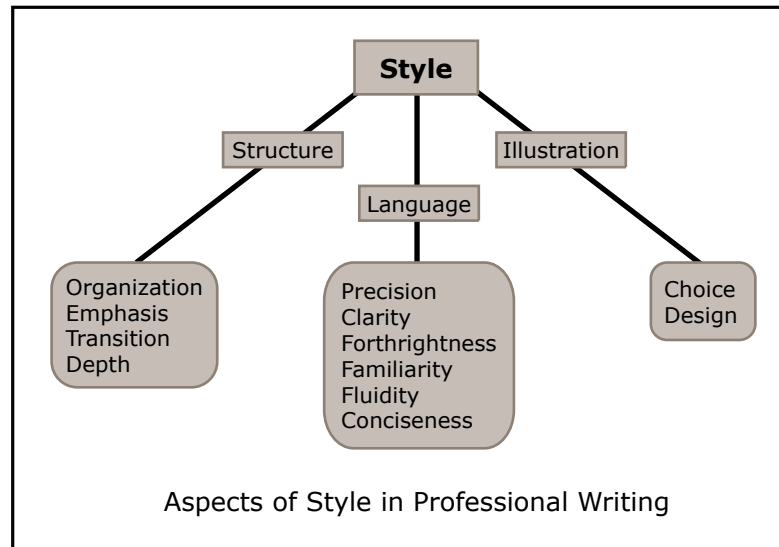


Figure by MIT OCW.

Structure

Title:

does not orient (17)

is too long (18)

Introduction:

does not define scope (27)

does not show importance (28)

does not give background (30)

does not map (31)

Conclusion:

does not analyze (41)

does not provide closure (41)

Transitions into sections:

first sentences abrupt (55)

reader not oriented (54)

Summary:

does not map, if descriptive (22)

does not inform, if informative (23)

Middle:

strategies illogical (33)

headings not descriptive (38)

headings not parallel (39)

depth inappropriate (59)

Appendices:

are not introduced in text (49)

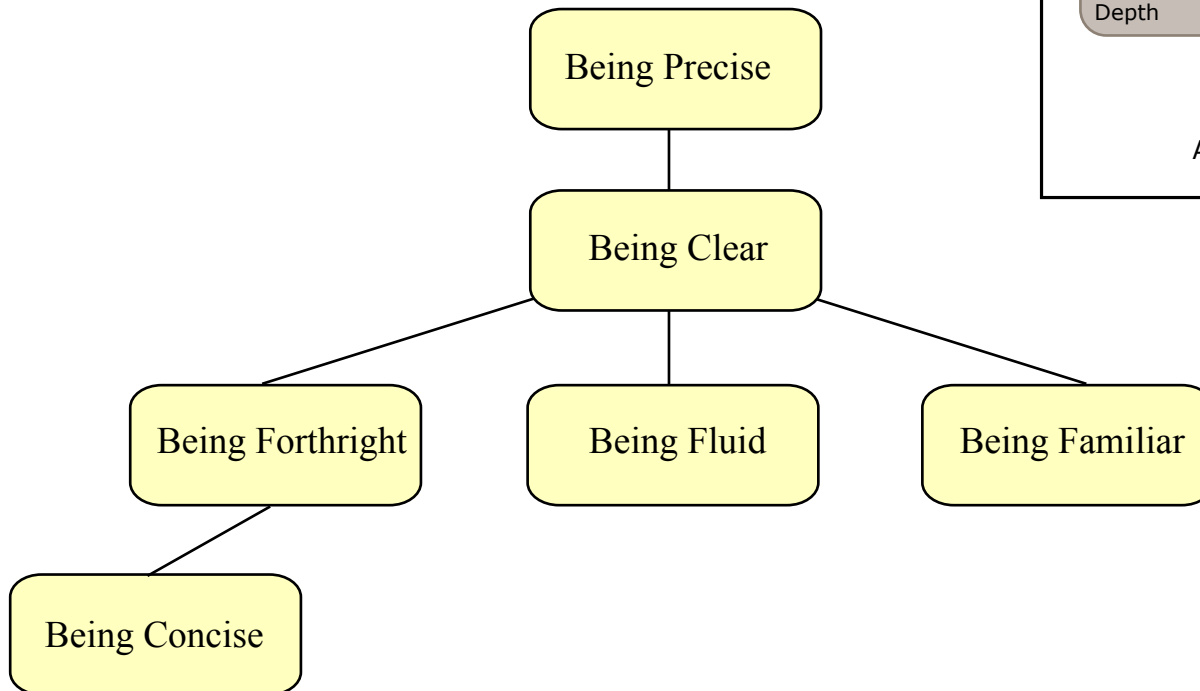
do not stand alone (47)

Emphasis of results:

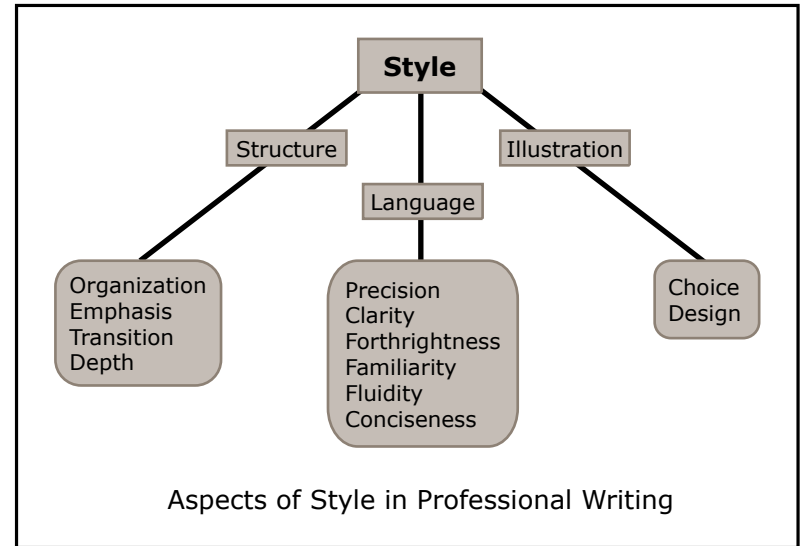
repetition not used well (64)

placement not used well (66)

Language Goals



A hierarchy of language goals in professional writing.



What We Look For in Language (checklist)

Language

Imprecision, word choice
(73)

Needless complexity:

in word choice (84)

in noun phrases (85)

in sentence structures (86)

Too many abstract nouns
(102)

Tone not controlled (97)

Terms undefined (112)

Needless words (119)

Imprecision, level of detail (78)

Ambiguities:

from word order (92)

from unclear pronouns (93)

from punctuation error (94)

too many passive verbs (104)

Discontinuity:

from stagnant rhythms (129)

from poor transitions (137)

Language: Word Choice

Errors that
would unsettle
many readers

affect, effect
its, it's
lead, led
principal, principle
lie, lay

Errors that
would distract
many readers
or change the
sentence's
meaning

than, then
a, an, the
amount, number
phenomenon, phenomena
criterion, criteria
continual, continuous
fewer, less
adverse, averse
good, well
that, which
medium, media
stratum, strata
compose, comprise
who, whom
as, like
anxious, eager
ensure, insure
enormity, enormousness
nauseated, nauseous

Errors that would distract
only a few readers

farther, further
more than, over
alternate, alternative, option
compare to, compare with
different from, different than
because of, due to
if, whether
more important, more importantly

A hierarchy for commonly confused word pairs (an issue of usage) in professional documents.
A discussion of each word pair appears in the Appendix.

After Alley, 1996.

Language: Needless Complexity

EXAMPLES OF NEEDLESSLY COMPLEX WORDS		
CATEGORY	EXAMPLE	POSSIBLE SUBSTITUTE
Nouns	Familiarization Has the functionability Has the operationability Utilization	Familiarity Can Function Can Operate Use
Verbs	Facilitate Finalize Prioritize Utilize	Cause End Assess Use
Adjectives	Aforementioned Discretized Individualized Personalized	Mentioned Discrete Individual Personal
Adverbs	Firstly, Second, Thirdly Heretofore Hitherto Therewith	First, Second, Third Previous Until now With

Language: Too Many Abstract Nouns

- Original:
 - *The existing nature of Mount St. Helens' volcanic ash spewage was handled through the applied use of computer modeling capabilities.*
- Revised:
 - *With Cray computers, we modeled how much ash spewed from Mount St. Helens.*

Language: Needless Words

- (already) existing
- At (the) present (time)
- (basic) fundamentals
- (completely) eliminate
- (continue to) remain
- (currently) being
- (currently) underway
- (empty) space
- Had done (previously)
- Introduced (a new)
- Mix (together)
- Never (before)
- None (at al)
- Now (at this time)
- Period (of time)
- (private) industry
- (separate) entities
- Start (out)
- Write (out)
- (still) persists

Language: Ambiguities

- Word Choice:
 - *T cells, rather than B cells, appeared **as the** lymphocytes migrated to the thymus gland.*
 - *T cells, rather than B cells, appeared **because the** lymphocytes migrated to the thymus gland.*
- Syntax: (the ordering of words within a sentence)
 - ***In low water temperatures and high toxicity levels of oil,** we tested how well the microorganisms survived.*
 - ***We tested how well the microorganisms survived** in low water temperatures and high toxicity levels of oil.*
- Pronouns: (particularly “it” and “this”)
 - *Because the **receiver** presented the **radiometer** with a high-flux **environment,** **it** was mounted in a silver-plated stainless steel container.*

Language: Strong Versus Strong Verbs

- made the arrangement for
 - made the decision
 - made the measurement of
 - performed the development of
- arranged
 - decided
 - measured
 - developed

Language: Passive Versus Active Voice

- The voltage was displayed by the oscilloscope.
- The feedthrough was composed of a sapphire optical fiber,
- which was pressed against the pyrotechnic
- that was used to confine the charge.
- The oscilloscope displayed the voltage.
- The feedthrough contained a sapphire optical fiber,
- which pressed against the pyrotechnic
- that contained the charge.

Why Use Strong Verbs and Active Voice?

- Because they're lively and require fewer words.



Language: Common Grammar, Punctuation, Usage, and Spelling Errors

Errors that would unsettle many readers	run-on sentence (comma splice) fragment missing introductory comma major usage error (its, it's) misspelling (spell checker would catch)
Errors that would distract many readers or change the sentence's meaning	unclear pronoun reference missing parenthetical comma subject-verb disagreement verb tense error faulty parallelism misplaced modifier usage error (criterion,criteria) irregardless alright typo (spell checker would miss) missing series comma colon error semicolon error possessive error center around very unique capitalization error quotation marks misplaced numeral error subjunctive error.
Errors that would distract only a few readers	data used as singular ending sentence with preposition split infinitive contractions such as can't minor usage error (if, whether) panacea for

A hierarchy for grammar, punctuation, usage, and spelling errors in a professional document. A discussion of each listing appears in the Appendix.

After Alley, 1996.

What We Look for in Illustrations (checklist)

Illustration

Illustration is not introduced (162)

Illustration is not discussed (164)

Illustration does not mesh (164)

Caption is not specific (163)

Illustration is misplaced (167)

Illustration raises question (161)

Label is missing or incorrect (162)

Caption has incorrect form (163)

Choose the Right Type of Illustration

- **Charts and graphs:** convey trends, comparisons, relationships
 - **Line graphs:** trends
 - **Bar graphs:** magnitude
 - **Pie charts:** relative portions of the whole
- **Photographs:** provide absolute proof
- **Chemical structures, reactions, mathematical expressions:** essential for theories and processes

Proper Form for Tables

Table removed for copyright reasons.

“Column dimensions in ACS Publications.”

Source: Dodd, James S. *The ACS Style Guide: A Manual for Authors and Editors*. 2nd ed. Washington, D.C.: American Chemical Society, 1997. ISBN: 0841234620.

Figure Captions

Text removed for copyright reasons.

Source: Dodd, James S. *The ACS Style Guide: A Manual for Authors and Editors*. 2nd ed. Washington, D.C.: American Chemical Society, 1997. ISBN: 0841234620.

What We Look For in Format (checklist)

Image removed for copyright reasons.
Source: Alley, 1996.

Format: Headings

Image removed for copyright reasons.

Format; Citations

Text removed for copyright reasons.

Source: Dodd, James S. *The ACS Style Guide: A Manual for Authors and Editors*. 2nd ed. Washington, D.C.: American Chemical Society, 1997. ISBN: 0841234620.

Format: Reference List

Periodicals

Recommended Formats

Author 1; Author2; Author 3; etc. Title of Article. *Journal Abbreviation* Year, *Volume*, Inclusive Paginatio

Author 1; Author2; Author 3; etc. *Journal Abbreviation* Year, *Volume*, Inclusive
Pagination

Source: ACS Style Guide.

Formatting Instructions

- **DOUBLE SPACE** all documents
- **Always include page numbers**
- Laser quality print
- Time or Times New Roman font
- 12 pt
- Standard manuscript paper 8 1/2 x 11
- 1 side of paper
- 1 column
- Ragged right
- 1-inch margins

Vigorous Writing is Concise

Text removed for copyright reasons.

Source: Strunk, W., and E. B. White. *The Elements of Style*, 4th ed. Boston, MA: Allyn and Bacon, 2000. ISBN: 020530902X.