Scientific Writing

Guidelines for Writing Assignments in the Department of Geological Science Writing Intensive Program

Part I – Introduction & Overview of the Writing Process

Communicating effectively is critical to your future

- How well you communicate affects your career (and your grades)

  - Written communications

    Reports
    Articles
    Proposals
    Web Pages

  - Oral communications

    Conferences
    Lectures
    Meetings
    Posters

Three aspects of writing affect the way that readers assess your documents

- **Content**
  Research
  Data
  Analysis
  Interpretation
  Models
  Conclusions

- **Style**
  Structure
  Language
  Illustration

- **Form**
  Typography
  Layout
  Mechanics
  • grammar
  • usage
  • punctuation
  • spelling
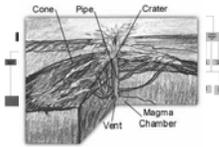
Lecture Series Overview — OWL

- Assigned Reading from:
  - *The Craft of Scientific Writing* - by Michael Alley
  - The Purdue Online Writing Lab (OWL)
    http://owl.english.purdue.edu/owl/
- Getting Started
  - The importance of writing
  - Document planning, constraints and style (an overview)
  - Mechanics - avoiding some common grammar errors
- Structure *(two sections)*
  - Organizing your documents
  - Providing transition, depth & emphasis
- Language
  - Precise, Clear, Forthright, Familiar, Concise & Fluid

Stages of the writing process

- Getting in the mood
  - Preparing to write
- Writing the first draft
  - Thinking & writing
- Revising, revising, revising
  - Rewriting
- Finishing
  - Attending to layout/format

Things to think about, know & do before you get started

- Think about and know your assignment
  - What is it?, Objectives, Resources, Timing
- Know your document constraints
  - Audience, Occasion, Purpose
- Think about the style that you will use...
  - Structure, Language, Illustration
- Review grammar and mechanics of writing
  - See OWL – Grammar and Mechanics

  Assigned Reading: Alley, M. 1996, *The Craft of Scientific Writing*, 3rd ed. Chapter 1. Deciding Where to Begin
  OWL – Grammar & Mechanics, Starting the Writing Process, Understanding Writing Assignments

Make sure you understand your assignment

- Read the entire assignment through once
  - Gives you an overall view of what is going on
- Underline or circle the information that you absolutely must know
  - Due date, research (source) requirements, page length, and format
- Underline or circle important phrases/requirements
- Think about and make notes about how you will address the assignment

- See OWL – "Understanding Writing Assignments"

Start your writing process by thinking and planning
Writing is a process, not a product

- What are your objectives
- What resources will you need
  - References, data, time
- What do you need to know before writing?
- Schedule blocks of time for
  - Research, organizing, writing, revising
- Devise a plan of action to address specific aspects of … Research, organizing, writing, revising
- Topic outline, organization, pre-writing

Analyze your constraints

Audience
- Who are they?
- What they know
- Why they will read
- How they will read

Occasion
- Format
- Formality
- Politics and ethics
- Process & deadline

Purpose
- To inform?
- To Persuade?

Communication depends on the situation

- Different audiences
- Different formats
- Different politics
- Different purposes
- Different subjects

Reports
Articles
Proposals
Web Pages

Who is your audience?

- Your boss, a client, co-worker?
  Management (your professor?)
- Your answer determines
  - Your choice of words
  - The detail of illustrations you can present
  - The depth of your presentation
  - The kinds of bridges that you have to construct for your audience from known information to new information

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Assessing the Audience

- Who will read it?
  - How mixed is the audience?
- What do they know about the subject?
  - How much background do you have to present?
 - If mixed, what is the primary audience?
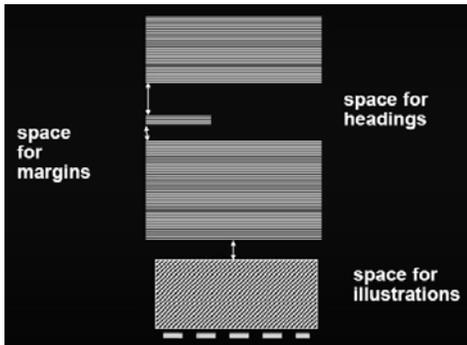
Assessing the Audience

- Why will they read it?
  - What do they want to know?
  - What do you need to emphasize?
- How will they read it?
  - Thoroughly, front to back (rarely)
  - Scan it for topics or data (more likely)
  - Quick scan for general content (e.g. a letter)

Format - the way the type is arranged on the page

- Formats vary considerably in different situations:

Formal Reports | Journal Articles | Presentation Slides
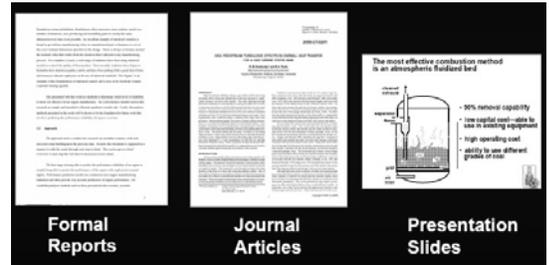
Layouts use white space for associations, emphasis, hierarchy

space for headings

space for margins

space for illustrations

Format variables
are generally dictated for you

- Typeface used
  - Verdana, Times New Roman, **flubber**...
- Whether and how topic headings are used
  - FULL CAP, First Cap, underline, *italics*...
- The way pages, table & figures are numbered
  - Figure 1, Fig. 1, fig. 1
- The way sources are referenced
  - (Jones and others, 2003), Jones et al., 2003, (14)

Politics

- Satisfying an employer
- Satisfying a lawyer or bureaucrat
- Confusing prose vs clear prose
- Honesty (to yourself or others)
- Ethical responsibility

What is the purpose of your document?

- Informing the reader?

  - Use a style that communicates the most information in the least reading time
  - Emphasize important details by placing them where they will stand out

What is the purpose of your document?

- Persuading your reader?

  - Present logical arguments in the most convincing manner
  - Conclusion placement depends on audience

Writing Style

- Style is the way that you put your thoughts into words and images. Includes, for example:
  - The way you emphasize details
  - Sentence length and structure you use
- Three basic elements of style:
  - Structure
  - Language
  - Illustration

Structure
of the document
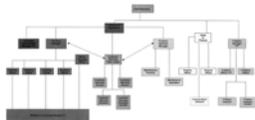
- Structure is the most important element of your style

- Structure includes:
  - Organization of the document
  - Depth of details
  - Transition between details
  - Emphasis of details

Structure
of the document

- Document structure is not just a template for your document, but the way you use the language to guide your audience

Language
of the document

- Includes:
  - Choice of words
  - Arrangement of words in phrases and sentences
  - How you use numbers, equations, abbreviations
 - How you use examples and analogies

Language
of the document

- Saying what you mean precisely and clearly
- Use language familiar to your audience
  - Relate the familiar to the new
- Make your statements concise and forthright
- Make your statements flow from one to another

There are six goals of writing

- Your writing should be:
  - Precise
  - Clear
  - Forthright
  - Concise
  - Familiar
  - Fluid
- Some of these goals follow from one another

Illustrations can be very useful
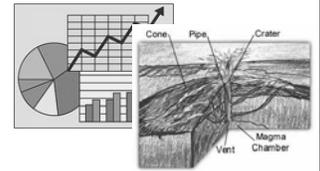
- Illustration
  - The meshing of figures and tables with language
- Illustrations make your writing efficient by clarifying concepts that are too complex to be conveyed by language alone
  - Used for emphasis
  - Used for detail
- Use may be governed by format constraints

Mechanics

vs

- The rules:
  - Punctuation - , : ; ' - – ( ) " "
  - Grammar
    - Subject-verb agreement
    - Pronoun usage
    - Pronoun-antecedent agreement
    - Adverb & adjective usage and placement
    - Verb tense
    - Parallel structure
    - Sentence fragments
  - Word usage *(affect - effect; principal - principle)*
 - See OWL – "Grammar and Mechanics"

Part II - Structure

Organization

Organizing Your Documents

Assigned Reading: Alley, M. 1996, *The Craft of Scientific Writing*, 3rd ed. Chapter 2. Organizing Your Documents
OWL – Introductions (Argument and Exploratory Papers)

" A whole is that which has a beginning, middle, and ending." -- Aristotle

Three Basics Sections of a Document

Beginning

Middle

Ending

Beginning
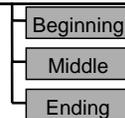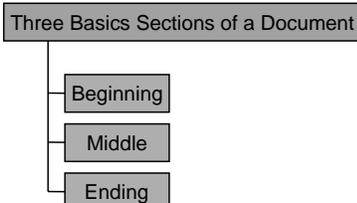
Middle

Ending

Their Functions

- Beginning- prepares the reader for the middle by fulfilling certain expectations:
  - Defines the work to be described
  - Indicates why it was done
  - Gives background for understanding the work
  - Indicates how the work will be presented
- Middle – presents the work in a logical order
- End – provides analysis, summary, and future perspectives

In the Beginning…

- The beginning has just one task:
  - To prepare the audience for understanding the middle
- It determines whether the audience will continue to read the document
- Beginning of a scientific document includes:
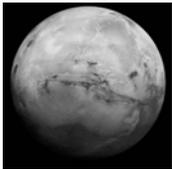 - Title
  - Summary/Abstract
  - Introduction

The Title

- The title is the single most important phrase of a scientific document
- A strong title orients the reader by:
  - Identifying the field of study
  - Separating the document from others in the field

What's enough – what's too much?

- The title should give enough details, but only enough, to provide this orientation for the reader

  - Weathering in Martian atmospheres
  - Experimental weathering of iron-bearing phases in Martian atmospheres
  - Weathering of iron-rich phases in simulated Martian atmospheres

The Abstract / Executive Summary

"Please be good enough to put your conclusions and recommendations on one sheet of paper at the very beginning of your report, so that I can even consider reading it."

-- Winston Churchill

The Abstract / Executive Summary

- An *abstract* is a summary of a body of information
- Sometimes, abstracts are in fact called summaries -- sometimes, executive summaries or executive abstracts
- There are two different kinds of abstracts
  - Descriptive abstracts
  - Informative abstracts

Descriptive Abstracts

- Descriptive summary –
  - Tells what kind of information is in the document
    - Main topic
    - Purpose of the work
  - An overview of the contents in paragraph form
  - No summary of facts or conclusions
- *"This report provides conclusions and recommendations for improving the quality of drinking water provided by water fountains at the University of Missouri, Columbia. Methods of sampling and analysis are described, and implications for student health problems are discussed."*
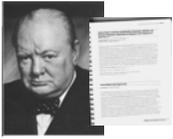
Informative summaries/abstracts

- Informative summary –
  - Provides results that are described in the work
  - It is a synopsis of the work
  - It may also provide a guide to the organization of the report
- Most scientific abstracts and executive summaries are informative

Writing an Informative Abstract

- The abstract should provide the most important information in the article
  - Tell the reader <u>what</u> happened and your conclusions
  - Use the rest of the document to let them know <u>how</u> it happened & <u>why</u> you concluded…
- The next most important purpose of the abstract is to help guide the reader through a complex document

Writing an Informative Abstract

- Start by identifying the project
- State the major results and conclusions of the study
- Repeat and summarize information presented in the body of the paper
- Should stand <u>independent</u> of the paper itself
- Generally the last part of a paper to be written

Which Type of Abstract?

Reports
Articles
Proposals
Web Pages

- Commonly depends on your audience

- May depend on format constraints

Writing the Introduction

- By the end of the introduction, your reader should understand:
  - What is the work that is being reported?
  - Why is it important?
  - How does it fit into a broader context?
  - What background is needed to understand the work?
  - How is it being reported?
- Introductions vary in type and question order
- Your introduction may not address each of these questions explicitly --- depending on the work or the audience

Writing the Middle
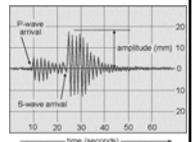
- State what happened and how it happened
- State the results, where they come from
- Discuss what the individual results mean
- You select a strategy for presentation and convey that strategy to the audience in your choice of heading and subheadings

Strategies

- Types of strategies:
  - Chronological – used in discussions of timeline or cyclic processes
  - Spatial – to follow the pattern of a physical form
  - Flow – to follow the change in some variable through a system
  - Cause and effect
  - Division and classification

Strategies
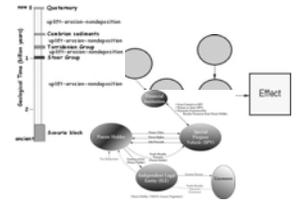
- More than one strategy may be used at different levels in a single paper
- The best strategy to use depends on your subject and your audience

Creating Sections and Subsections

- Sections and subsections
  - Outline the strategy for the reader
  - Act as a roadmap
  - Allow the reader to jump to the information they want

Creating Sections and Subsections

- Section titles should use the same guidelines as paper titles
- Use parallel construction for headings
- Test headings by viewing them as a table of contents

Endings of Documents

- Analysis of the most important results from the document's middle section
  - Results are treated as a whole rather than individually as they are in the middle section
  - Show the ramifications of the results to the big picture

Endings of Documents

- Future perspective on the work
  - Recommendations
  - Future directions
- Mirror the scope and limitations of the work as stated in the introduction