

Introduction to **Scientific Communication**

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Course objectives

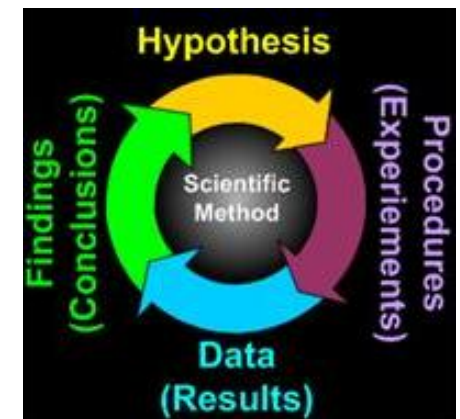
- The course provides a systematic review of the principles and practice of the various modes and forms of scientific communication including scientific papers, technical reports, presentations, and proposal writing
- Together we will identify the different objectives of these communication modes, and understand key steps and ingredients for effective scientific communication
- The course emphasizes basic skills for critical evaluation of scientific communications and provide opportunities for practicing these principles

Computer skills and proficiency

- Group and class presentations will be created using Microsoft Powerpoint – please make sure you are familiar with applying uniform slide format, change fonts, insert images and video files, launch slide animation, add comments, save and print slides and handouts
- Reports will be typed using Word or any other word processing software – please ensure you know how to format and use spellchecker
- Web resources and searches would typically be done using *Google* or *ISI Web-of-Knowledge* resources (citations!)
- Materials on course website are posted in PDF format

Science and scientific communication

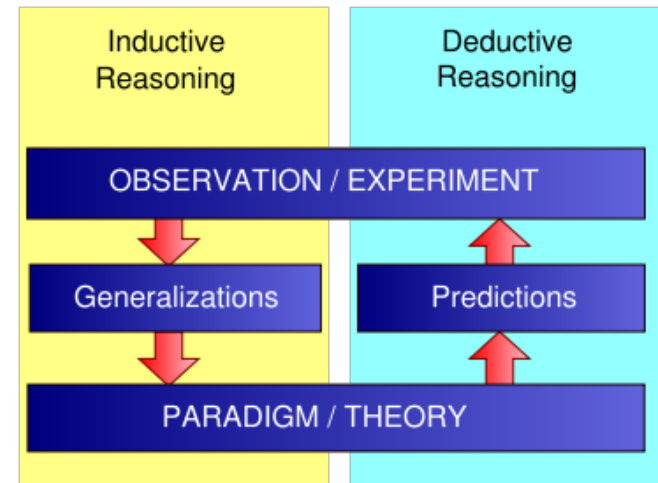
- **What is Science?** *“Science is the systematic enterprise of gathering knowledge about the world and organizing and condensing knowledge into testable laws and theories.”*
- The objective of **scientific communication** is to accurately and clearly communicate (new) scientific knowledge, hence it is intimately linked with **the scientific method**
- **The Scientific Method**
 - Make careful observations of the world
 - Ask a question based on what has been seen
 - Propose some tentative answers/hypotheses
 - Use the hypotheses to make predictions about new as yet unobserved data/phenomena
 - Test predictions by making observations of new data
 - Reject hypotheses that fail to predict new observations



The scientific method and communication paths

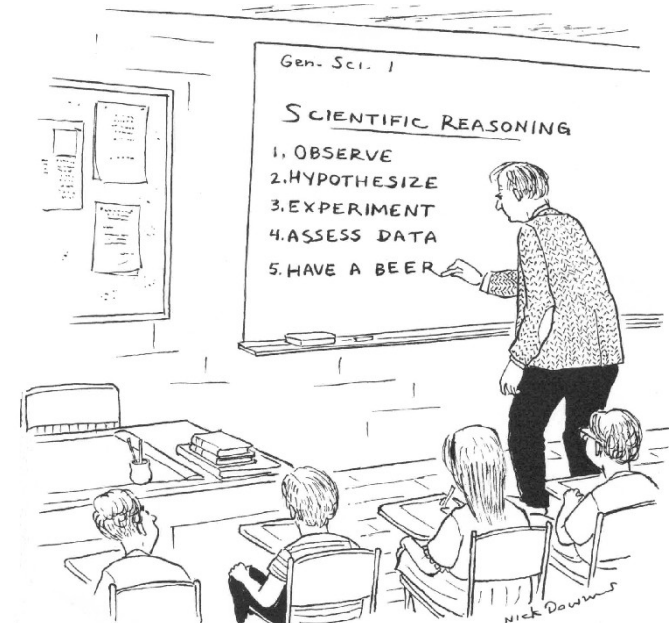
The Scientific Method

- ◆ Observe and question
- ◆ Propose tentative hypotheses
- ◆ make predictions about unobserved phenomena
- ◆ Test by making observations
- ◆ Reject hypotheses that fail to predict new observations



The Scientific communication path

1. Define the question
2. Gather information and resources
3. Formulate hypothesis
4. Perform experiment & collect data
5. Analyze data
6. Interpret and draw conclusions for new hypotheses
7. Publish/communicate results



Scientific communication is now part of your life..


- It may be hard to accept – but in your professional life you will be **EXPECTED** to communicate effectively, it is part of your job...



What are common modes of scientific communication?

- Writing scientific papers
- Making a scientific or technical presentation
- Writing research or project proposal
- Extracting, searching & creating Web pages

TEN THINGS PEOPLE FEAR THE MOST

-
1. **SPEAKING BEFORE A GROUP** 
 2. **Height** 
 3. **Insects and bugs** 
 4. **Financial problems** 
 5. **Deep Water** 
 6. **Sickness** 
 7. **Death** 
 8. **Flying** 
 9. **Loneliness** 
 10. **Dogs** 

Why would you need scientific communication?

1. The quality of your PhD, MSc and post-graduate career depend on it
2. Your professional success in any future workplace relies on your technical communication skills (making effective presentations, writing proposals, compiling technical reports, etc.)
3. Mastering scientific communication and acquiring these skills would probably payoff more than any other single topic you have studied



Scientific communication is
key to professional success



Modes of scientific communication

1. Making a scientific or technical **presentation (or poster)**
2. Writing technical **reports**
3. Writing scientific **papers**
4. Writing research or project **proposals**
5. Data and information from the **Web**

These diverse communication activities require skills:

- Computer and technical proficiency
- Organized thinking and ability to abstract ideas
- Good mastery of language, and in the global context often in English
- Differentiating and understanding the objectives of each communication mode (audience, clients, goals)

A quick tour of available web resources

- The Web offers virtually unlimited resources, information and examples for scientific communication

1. Michael Alley, 1996, The Craft of Scientific Writing (3rd ed) Springer
2. <http://www.writing.eng.vt.edu/index.html>
3. <http://www.io.com/~hcexres/textbook/acctoc.html#examples>
4. The Elements of Style (online)
<http://www.bartleby.com/141/>
5. <http://www.cimms.ou.edu/~schultz/communication.html>
6. <http://www.presentation-pointers.com>



Elements of effective presentation

1. Tell an interesting story, know and calibrate for the specific audience – *it's showtime*
2. Outline, motivate, coherence, clear message, continuity
3. Creating slides – simple and clear content (**next section**)
4. Delivering – practice, take control, show enthusiasm, look at the audience, even when nervous and lack confidence “fake it” and don't apologize
5. A presentation is very different than a paper or a report



Scientific/technical proposal

- Proposals are often written to secure research funding, to win a consulting contract – the primary objective here is to ***persuade*** reviewers/funding agency to provide funding to solve a problem
- **Primary difficulty in proposal writing** - you imagine a solution to a problem and write about the steps towards the anticipated solution (this is not something we know...)
- **Format of a proposal** – solicited proposals require that you adhere to strict format for uniform evaluation, to ensure certain content, and to check *whether you are able to follow instructions*
- **Funding landscape and “politics”** – have you addressed the scope of the call? Is the topic and proposed work appropriate for the call? Is the collaboration appropriate?
- **The audience** – management look at costs, feasibility, timeline; technical types look at science, innovation (both groups must be persuaded for successful funding)

Proposal style

1. Title (*orient the audience*)
2. Introduction
3. Problem statement
4. Assertions set up proposed solution
5. Assertions are supported
6. Proposed solution is pitched (*does solution make sense from technical point of view? Does it make sense from management point of view? Can the proposal writers do it?*)
7. Objectives are concise, clear and logical
8. Plan of work – in connection with objectives (how solution is developed)
9. Management plan – timeline, budget, Q-A, collaboration
10. References
11. Appendices - facilities, qualifications (CV),

Elements of a technical report

- Cover letter, title page and summary

Report on

THE VIDEO ALERT AND CONTROL DASHBOARD SYSTEM

Submitted to

David McMurrey
Department of Safety Engineering
Automotive Research Corporation

June 6, 1996

This report is an informative study of the Video Alert and Control dashboard system. The report describes the different components and their functions as well as a complete cycle of operation of the system. Also included are sections concerning economic feasibility and advantages of the system.

Elements of a technical report (2)

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS	iii
ABSTRACT	iv
I. INTRODUCTION	1
II. DESCRIPTION AND FUNCTION OF COMPONENTS	2
Infrared Detector	2
Radar Sender and Receiver	3
X-ray Sender and Receiver	4
On-Board Computer	5
Map Discs	5
Receptions from the Detectors	5
Video Screen	6
Keyboard	7
Car Positioning	7
Intersection Statements	8
Brake Applicator	8
III. OPERATING CYCLE OF THE VAC SYSTEM	9
IV. ECONOMIC FEASIBILITY OF THE VAC SYSTEM	11
V. ADVANTAGES OF THE VAC SYSTEM	12
VI. CONCLUSION	13
List of References	14

The structure of a scientific paper

1. Title (*orient the audience*)
2. Authors and affiliations
3. Abstract
4. Introduction
5. Theory/Methods
6. Results
7. Discussion
8. Summary and conclusions
9. Acknowledgements
10. References

The order of a scientific paper

Scientific process	Section of paper
Orienting readers	Title
What was done in a nutshell?	Abstract
What is the problem addressed?	Introduction
How did we solve the problem?	Theory / Methods
What did we find?	Results
What does it mean?	Discussion
What have we learned (in short)?	Summary and conclusions
Who helped us?	Acknowledgements
Whose previous work did we rely on?	References
Additional information	Appendices

What is an informative **abstract** (for technical report)?

1. Summarizes key facts, information, and conclusions of the report
2. Less 5% of the report length (sometimes less than 150 words)
3. Summarizes the key information from each section
4. Phrases information in a very dense, compact way (long sentences)
5. Omits introductory explanation, definitions and other background information - it is not an introduction!
6. Omits citations
7. Includes key statistical detail - one expects to see numerical data in an informative abstract
8. Omits descriptive and abstract-phrasing focusing on key conclusions and recommendations (specifics)

What is an informative **abstract** (for a paper)?

An abstract summarizes, in one paragraph the major aspects of the entire paper in the following prescribed sequence:

1. the question you investigated (or purpose) (Introduction)
 - state the purpose very clearly in the first or second sentence
2. the experimental design and methods used, (Methods)
 - clearly express the basic design of the study
 - Name or briefly describe the basic methodology used without going into detail-be sure to indicate the key techniques used
3. major findings including key quantitative results, or trends (Results)
 - report those results which answer the questions you were asking
 - identify trends, relative change or differences, etc.
4. a brief summary of your interpretations and conclusions (Discussion)
 - clearly state the implications of the answers your results gave you