

English Communication Skills Technical Writing and Presentation

TW6b and PS4

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1 STARTING STRATEGIES¹

This section of the course will deal predominantly with the creative side of the thinking and writing process. The main idea behind it is:

Clear thinking leads to clear writing

1.1 FORMING A POINT OF VIEW

1.2 IDENTIFYING AUDIENCES AND PURPOSES

¹ [Adapted from Huckin & Olsen, 1991]

1.1 FORMING A POINT OF VIEW

In developing a report of any kind, much time will be spent on the **pre-writing** stage: that is, you will come up with a potentially interesting hypothesis, survey the literature, refine the hypothesis, run the experiments and the results, all the while thinking about how your work fits in with other work in your field.

The goal of this section is to help you in the generation and organisation of your ideas, so that when you come to the writing stage, it will flow more easily.

Generating ideas

Several techniques can be used in generating ideas: defining the problem and your task; brainstorming; using systematic questions as prompts; exploring information in libraries and databases. Not all the ideas you produce will be equally useful, in fact you will probably eliminate many of them at a later stage, but right now the goal is not to evaluate or criticise but simply produce new, creative thoughts.

Defining the problem and your task

Before you can begin to generate ideas, you need to have something to generate ideas about. This means

- 1) identifying the problem you need to address, and
- 2) determining how you are supposed to address it.

A report may involve one major problem, but it could also consist of a number of related problems. In that case, it is useful to make a list of the problems and see how they relate to one another: are some of them sub-problems within others? You can create a tree-diagram of problems, with the most important one at the top, then, when generating ideas, you can focus on each problem in a logical order.

Having defined the problem, you need also to be clear on what exactly your task is: What are you expected to do about it? To describe it? To propose an approach to solving it? To recommend a solution? Are you supposed to deal with the whole problem or just a part of it? Clarifying your task will help streamline your thinking.

Brainstorming

One way to generate ideas is just to try brainstorming: that is, to talk out or write down any and every idea you have about the problem in question. If you are alone you can try 'free-writing': this involves jotting down on paper all the ideas and terms that relate to the topic. It doesn't matter if it all looks like a jumble. The whole point of the creative exercise is to let your mind range freely over the topic. Often, brainstorming is best done with others: by bouncing your ideas off each other, you stimulate new ideas.

Half-an-hour Exercise

Brainstorm about a report topic: write down as many ideas as you can think of in 15 minutes. Try to cover at least one sheet of A4.

Now, in the next 15 minutes delete any items that you feel are less important or irrelevant. Look for patterns and themes, or links between the ideas. Use colours, symbols, arrows or numbers to tidy up the various items left.

Using systematic questions as prompts

Once you have brainstormed, you might want to try a more systematic approach, to make sure you do not overlook any vital information. Relevant material might arise from exploring:

- The subject matter
- The requirements of the subject field, and the kinds of argumentation expected within that field
- The requirements of the type of writing expected
- Your audience
- Institutional concerns, ie issues that your institution wants to emphasise.

In this section, we look at the kinds of questions you can use as prompts to consider the first two areas listed above but you will probably still have to generate questions of your own, specific to your individual topic.

General questions

Over 2000 years ago, Aristotle developed a list of common topics in order to consider any concept or thing. They are listed below along with some questions they can raise. By going through such a list systematically, you will have more sources of information to draw from than by just brainstorming randomly.

Definition

- A Genus: How does the dictionary define ____?
What are some concrete examples of ____?
- B Division: What parts can ____ be divided into?
What group of things does ____ belong to?

Comparison

- A Similarity: What is ____ similar to? In what ways?
- B Difference: What is ____ different from? In what ways?
- C Degree: What things does ____ differ from only in degree?
____ is superior (inferior) to what? How?
____ is most unlike (like) what? How?

Relationship

- A Cause/Effect: What causes ____? What are the effects of ____?
- B Antecedent/Consequence: What comes before (after) ____? What is the consequence of ____?
- C Contraries: What are other possible but opposing solutions to ____?
- D Contradictions: Is there anything that argues against ____?

Circumstance

- A Possible/Impossible: Is ____ possible or impossible? What qualities, conditions, or circumstances make ____ possible or impossible?
- B Past Fact/Future Fact: When did ____ happen in the past? If ____ starts, what makes it end? What is necessary for ____ to happen now? What would prevent ____ from happening?

Testimony

- A Authority: What do experts say about ____?
- B Testimonial: What do users say about ____?
- C Statistics: What quantitative data can we use to talk about ____?
- D Maxims: Do we know of any platitudes about ____? (proverbs, poems, sayings)
- E Law: Are there any laws about ____?
- F Precedents/Examples: What has been done so far? Have there been previous attempts to make/use ____? If so, how successful were they?

Specific questions

Some situations already have well-defined categories for exploring and generating ideas. For instance, suppose you were asked to do a technical evaluation of someone's research. The specific questions you would ask would depend on the type of methodology used: experimental, analytical, simulation, or theoretical. Here are some examples to stimulate your own systematic questioning as regards your topic.

Experimental methods (which collect data to verify theory)

1. Is this an idealised or a "real" situation? What are the characteristics that make it idealised or real? To what degree is it idealised?
2. Is the experiment repeatable?
3. Does it use standard or invented or adapted procedures?
4. What kind of experimental apparatus is used?
5. Was the experiment looking at the "right" parameters (what is the adequacy of the experimental design)?
6. Was it using a good measurement scheme (was it looking at the "right grain" or level of detail)?
7. Was it using appropriate criteria these change!
8. How did you treat calibration problems and experimental error?
9. Was there a sufficiently large body of data?
10. What is the validity of the data?
11. Do the results support or contradict existing theory?
12. Is this the best method?

Analytical methods (which use existing theory to analyse a body of data)

1. What is the nature of the data? Is it the same as the available experimental data?
2. How were the data collected?
3. How should the data be classified?
4. Is there a solution to the problem being analysed? Is an exact solution known? If so, how do the data used for the analysis compare with the known solution(s)?
5. Can existing theory explain the results of the analysis? If not, is there a new or alternative explanation of the result?
6. What is the analytical approach? If this is a new approach, how does it compare with the old approach?
7. What are the assumptions behind the analytical method?
8. What is the model behind the analytical method?
9. Why are the model and assumptions applicable to the data?
10. What are the initial and boundary conditions?

Simulation methods, both computerized and non-computerized (which present alternative ways to generate data for complicated situations in which it would be too expensive or too difficult to use normal experimental techniques)

1. Can the reality being studied be simulated?
2. Where does the simulation fall on a scale of representation from reality to idealisation?
3. How does the model compare with theoretical and experimental results?
4. What is the method of simulation?
5. How many simulations were run and what was the size of the runs?
6. What are the inputs to the simulation?
7. What is the purpose of the simulation?
8. What are the underlying assumptions/simplifications?
9. What are the validity measures?
10. What were the calibration measures and efforts?
11. What were the error criteria for an acceptable simulation?
12. What were the boundary conditions?
13. What are the yields of the simulation? Do they make sense? How do they compare with historically accepted data? How do they compare with the results of analytical methods?
14. Was there an evaluation of the first set(s) of results and then feedback to subsequent runs of the simulation?

Theoretical methods (which develop new theory to explain existing data or predict new data)

1. Why is the new theory needed? What are the problems with the existing theory?
2. Do you have enough proof to argue that the new theory is adequate?
3. How does the new theory compare with the old theory? Is a generalisation of the old theory? An extension or different point of view? A contradiction? A replacement?
4. What are the new theory's assumptions? Are they valid?
5. What are the limitations and boundary conditions?
6. Does the new theory lead to a more accurate explanation of existing data or theories?
7. Does it predict any new data or theory?
8. What are the implications of the new theory? Its applications?
9. What kinds of data can the theory handle?
10. How do the theoretical perspective and models and expectations affect the "reality" that we see?
11. How can you prove or defend your theory?
12. Is the theory provable?
13. What does the field accept as an adequate standard of proof for the theory?
14. How does the theoretical result perform in practice?

Finding information

Once you have discovered the issues you need to consider and generated all the information you can by yourself, then you can check the library (and internet) for books and articles. To do this you need first to define your **key words**, (probably those that will feature in your title) and then either do a manual or computer search through the catalogue in the library. Looking up the work of specialist authors can also provide relevant information. You may also get the librarian to search national and international databases on the topic; there might be a charge, but it could save you a lot of time.

Forming a point of view

Once you have thoroughly explored your topic, and have generated a pile of ideas, you then need to order them into some form of argument. You need to identify your main points, realising, of course, that these could change as your work progresses. However, it is still useful to pull everything together to form a possible point of view from the ideas that you have generated.

Once you have identified a main point, you need to organise the rest of your ideas to support that point in some way. There are several ways this can be done, one of the most common is the outline.

Planning the writing: the outline

Once you have spent some time generating and developing your ideas, a writing plan is vital tool for organising those ideas and fixing them securely on the page. An outline, therefore, provides tangible evidence of your thought and planning. Its purpose is threefold:

- to clear/organise your thoughts
- to focus on what is relevant
- to construct a report that is logical and coherent in form

To write an outline, you should first decide what your main point is, then what the key ideas are (to support/illustrate your main point) and how these can be organised into a logical sequence of sections. Usually, a writing plan is solely for your own benefit, so feel free to alter it frequently according to your needs by crossing out items, adding in new ones, etc. In this way it becomes a valuable **Report Management Tool!**

Stages in producing an outline

Stage 1 Decide on/state your main point

Stage 2 State the key ideas (main lines of argument) to support your main point. At this stage your outline is very simple, so you can easily re-order your arguments.

FILL IN YOUR IDEAS HERE:

Main Point

- I first main line of argument
- II second main line of argument
- III third main line of argument

Your Title:

- Chapter 1:
- Chapter 2:
- Chapter 3:

Stage 3 Add in the first level of key phrases or points (sub-arguments) to support each main line of argument. At this stage, you are beginning to group related ideas together to form sections.

Main Point

- I first main line of argument**
 - A first sub-argument for I
 - B second sub-argument for I
 - II second main line of argument**
 - A first sub-argument for II
 - B second sub-argument for II
 - III third main line of argument**
 - A first sub-argument for III
- etc

Your Title:

- Chapter 1**
 - Section 1.1
 - Section 1.2
- Chapter 2**
 - Section 2.1
 - Section 2.2
- Chapter 3**
 - Section 3.1

Stage 4 Add in any further levels of argument (sub-headings), one level at a time. Now you can start noting any proofs you have (support, evidence, data, etc). To start off with, try to write one sentence for each section or sub-section and let your report 'grow' from there. Eventually your final outline will give a more complete picture of each chapter and the links between sections.

Main Point

- I first main line of argument**
 - A first sub-argument for I
 - 1 first proof for IA
 - 2 second proof for IA
 - 3 third proof for IA
 - B second sub-argument for I
 - 1 first proof for IB
 - 2 second proof for IB
 - 3 third proof for IB
- etc

Your Title:

- Chapter 1**
 - Section 1.1**
 - Section 1.1.1
 - Section 1.1.2
 - Section 1.1.3
 - Section 1.2**
 - Section 1.2.1
 - Section 1.2.2
 - Section 1.2.3

1.2 IDENTIFYING AUDIENCES AND PURPOSES

Audiences

Before you start writing anything, you should always think about **who** your audience will be, **why** you are communicating with them, and **what** you expect their response to be. This will help you to construct an effective piece of communication.

To help you think more clearly about this topic, first spend a minute reading each of the following two documents, and decide which one you prefer.

To: XXX, Public Relations
From: YYY, Naval Architect
Subject: Y-SHIPS: VESSEL CHARACTERISTICS
July 19, xxxx

I understand Senator Q's office has requested data on the Y-Ships for use in connection with his participation in launching the PRESIDENT Y-SHIP at Pascagoula, Mississippi. Following are the physical characteristics of these ships

Length overall	572'-0"
Beam	82'-0"
Depth to Main Deck	45'-0"
Designed Draft	28'-4"
Maximum Draft	30'-7"
Displacement at 30'-7" Draft	21,230 Tons
Cargo Deadweight	10,000 Tons
General Cargo Capacity	770,000 Cubic Feet
Refrigerated Cargo Capacity	48,000 Cubic Feet
Liquid Cargo	40,000 Cubic Feet or 1,000 Tons
Container Capacity	144 Containers
Passengers Carried	12 in Eight Staterooms
Crew	45
Propulsion	Steam turbine developing 24,000 HP driving a single 22'-6" diameter five-bladed propeller
Cruising Speed	23.0 knots
Cruising Radius	11,600 Nautical Miles

PRESIDENT Y-SHIP is the first of a new class of vessels known as the Y-Ships. The design was developed by ABC Company, Naval Architects, New York, to meet design and performance characteristics and service requirements established by ST Lines for vessels operating on Trade Route Number 17. This route links both the east and west coasts of the United States with the Orient and involves a round trip in excess of 30,000 miles. The 23-knot continuous sea speed capability is optimum for the long ocean legs in this service.

The Y-Ships are notable in several respects. They are the first merchant vessels in the world to be built almost entirely of low-alloy, high-strength steel. The result is a weight saving of approximately 330 long tons, as compared with a similar ship built of conventional shipbuilding steel. This is reflected in an equivalent increase in cargo capacity.

MS. Bothwell
U.S. Coast Guard Base
427 Commercial Street
Boston, Massachusetts

August 22, xxxx

Attention: Lt. G. L. Cousins
Subject: Clutch to disengage turbine starting pump

Dear Sirs

Thank you for the courtesy extended to our representative, Ed Smith, on his recent visit aboard the MS Bothwell, at which time he discussed with you your requirement of the clutch to be used to disengage the turbine starting pump from the main generator engine.

We understand you wish to mount the clutch on a shaft which would be turning 720 RPM, and that the duty of the turbine pump is 117 HP. Based on this, the torque requirement is 853 pound feet, and a clutch having 16.3 HP per 100 RPM is indicated. Twin Disk Model #CL-310 is rated 873 pound feet, 16.6 HP per 100 RPM, and 135 HP normal duty. The #CL-310 therefore would seem to fit the bill quite nicely.

We refer you to Twin Disk Bulletin #326-B, enclosed. On page 10 you will find the description, capacities, etc of this clutch. You will also note, it is available in 2 ¹/₄" and 2 ⁷/₁₆" bore. Accessories are described on page 11. Two possible spider drive arrangements are suggested, as described in Figures 2 and 3 on the back cover of the bulletin. The spiders and their dimensions are indicated on pages 18 and 19. We are pleased to quote as follows:

1. XA5752 Model #CL-310 Twin Disk Clutch in standard bore of 2 ¹ / ₄ " or 2 ⁷ / ₁₆ "	\$131.20
2. Part #3507 Throwout Yoke	2.25
3. Part #3039 Hand Lever	1.49
4. Part #1144-E Operating Shaft	2.15

The first one looks impressive, with its nicely formatted list. But if you think about it, that information is hardly suited to a senator's speech...

Good afternoon , ladies and gentlemen. We are gathered today to launch a Y-Ship of overall length 572', beam 82'-0", depth to main deck 45'-6", designed draft 28'-4" . . .

In fact, the really suitable information is right at the end, where the more general characteristics of the ship are listed. Given the intended audience of this letter, (ie the speechmaking senator), why do you think this engineer got into so much technical detail? He probably did it because that was what interested him most. However, he missed the mark as regards effective communication.

By contrast, if you analyse the second letter, you can see how well it meets its audience's needs. Notice how it begins: a polite thank you for the lieutenant's courtesy and a statement of the requirements he had asked about. It puts the needed information — the suitability of the clutch, ease of installation, and costs — in general terms, near the beginning of the letter and saves the detail for the end. The focus is on that which will help the lieutenant reach his decision, thus making it an effective piece of communication.

Characteristics of real audiences

Most of you have had experience in writing for teachers, who want detailed "show-what-you-know" type of writing which they intend to read carefully in order to give you a fair mark. Since they know more than you, they can fill in any missing elements in your argument and so on.

However beyond the tight constraints of the academic world, audiences are rather different. First of all, your audience might consist of a variety of readers, you might even have several possible audiences, and each of these will bring different reading strategies to your piece, some wanting to read in detail, others intending to skim through.

Some of the most important types of audience are:

1. Managerial
2. Non-specialist
3. Peer
4. International
5. Mixed

Managerial audiences

Managers are extremely busy, pressured people. They rarely have time to read any document in detail. They will usually read the Abstract, Introduction, and Conclusions sections of a report. In general, they look for important generalisations and tend to ignore details. To make your writing more easily understood by the managerial reader, you need to put key information at the beginning, where he can find it easily.

Non-specialist audiences

Non-specialist readers are those who know little about the subject, but are reading to find out more. Dissatisfied customers, potential clients, users of instruction manuals are all non-specialist readers and unlike managers, they are interested in details.

The problem is that you are used to talking about your subject in specialist terms, which this type of reader does not understand. It can be very difficult to think about your subject without your technical terms, but that is what you need to do to communicate with your non-specialist audience. You need to create a bridge of common knowledge with your reader.

To do this, you need to:

1. Use a conventional mode of presentation
2. Provide an overview
3. Give some background information
4. Explain any unusual terms or concepts by giving definitions, using examples, illustrations or analogies. But be careful, the last in particular can be misleading if not properly designed.

Peer audiences

When writing for your peers, you can use all the jargon you want, you do not need to spell every detail out for them, because they can fill in the gaps, if there are any. This means you can write concisely: both precisely and economically.

You should:

1. Use standard technical terms.
2. Use a conventional format.
3. Emphasise data and display it in standard ways, using graphs, tables etc.
4. Use standard forms of reasoning and argument.
5. Make your main points clear and accessible.
6. Be careful not to overstate your claims.

Experts are like managers in that they like to scan a piece for the major points, however, unlike managers, they also want to be able to focus in on key details. As an expert yourself, you need to decide what will interest your fellow experts and present it in an easily accessible form.

International audiences

Audiences are increasingly made up of a mixture of native and non-native speakers of English. To make sure that you can be easily understood:

1. Avoid translating directly from your own language into English.
2. Avoid overly long, complex sentences.
3. Avoid idiomatic language, i.e. slang, culture-bound expressions etc.
4. Use visual aids rather than verbal explanations where possible.

Mixed audiences

Many times, you will be addressing an audience consisting of a mixture of two or more of the above-listed types of reader. There are two basic ways to meet their different needs:

1. "Layer" the document, so that different sections are aimed at different audiences.
2. "Democratise" your writing, so that all audiences can understand all parts of it.

Long reports are usually layered: the first page presents background information and recommendations for the managerial reader while the body of the report contains details of interest to the specialist. In writing such a report, all you have to do is "switch hats" for each section!

When your mixed audience will want to read all of the report however, then it is better to democratise it. This means, taking your layered report and adding special information for your secondary audiences. You could explain some technical terms in the body of the report for the interested non-specialist, or insert such terms in the sections aimed at managers, but which experts might also want to read. This approach involves a lot of work, but can be necessary at times.

Exercise 1 Reformulate the first letter to make it appropriate for its intended audience.

Audience analysis

Identifying your audience, its characteristics and needs is essential for you as a writer since this analysis will determine how you should communicate. The following five steps will help you assess your audience.

1. Identify the communication's uses and routes.

Let us suppose your supervisor at work asks you to write a report on your current project, a software programme you are developing. You could just sit down and throw off a report just for him. But if you think about who else might also read the document, what routes it might travel, then you could come up with a much wider audience. Maybe your department head is also interested, perhaps the sales department would like to have a look, who knows, some outside organisation might also be interested...

2. Identify all possible audiences

It is quite possible that your work may be picked up, used, expanded on by others later, so you should try to identify all possible audiences, current or future, for a given piece of communication.

3. Identify the goals, concerns, needs and values of each audience

Engineers usually work in teams, and typically have to cope with a manufacturing unit, a marketing unit, a design unit, not to mention management. All of these will have different perspectives on the same subject: the sales department want money-spinners fast, while the design department want to advance the field, however long it may take; the manufacturing branch just want to know whether or not it will involve changes on the assembly lines. You need to consider your topic from the perspective of each audience so you can tailor your message accordingly.

4. Make it appropriate for managers

Managers almost always get to check out new developments, so it is always safe to include an executive summary of some kind. You may well need their support for your project.

5. Identify possible objections to and preferences for the arguments

Keeping in mind your different audiences, you then need to consider what kinds of arguments will cause them to view your project with favour, and what kinds of objections they are likely to raise. In this way, you can identify the approach which will most likely be effective.

Purposes

By the time you have identified the problem you need to address, determined your task, generated a heap of ideas, formed a potential point of view and analysed your audience, you probably have a fairly clear idea of your main purpose.

All communication is purpose-driven; the main purposes are: to **inform**, to **educate**, and to **persuade**. Having your own purpose clearly in mind will help you plan and organise your writing better. If you can make that purpose clear to your audience, they will find it easier to understand your message. For example, in long formal reports it is quite common to use an explicit purpose statement, such as: "The purpose of this report is"

Most pieces of writing have one main purpose, but you may have a hidden agenda as well, like wanting to be impressive enough to be promoted, or trying to get a certain piece of equipment installed in the office, when in fact you are writing a report about traffic circulation problems in Cairo. Just remember to concentrate on the real reason for the communication (your main purpose), or it might become incoherent, and thus misunderstood.

2 READING

2.1 YOUR READING STYLE

Many surveys of overseas students in further education report that their greatest **need** is the ability to read extensively and intensively. Some institutions ranked reading **first** as a requirement for success. How do you read in English?

TASK²

How do you usually read a chapter in a textbook or an article in a journal?

Look at the following statements. Put a tick (✓) if the statement corresponds to what you normally do.

1. ☐ I skim read (look quickly through) to get a general idea of what it is about before I begin.
 2. ☐ I start to read at the beginning and read right through.
 3. ☐ As I read, I ask myself what I already know about the topic.
 4. ☐ As I read, I ask myself what I will be tested on.
 5. ☐ I ask myself how the different parts relate to each other.
 6. ☐ Whenever I come across an unknown word, I look it up in the dictionary.
 7. ☐ I try to use diagrams and visuals to help me understand.
 8. ☐ I read every word carefully.
 9. ☐ I highlight the main ideas.
 10. ☐ My approach is basically the same, whatever I am reading.
-

Every time you read you should have a clear purpose in mind. Ask yourself:

- Why am I reading this book?
- Where does the reading fit into what I am studying?
- What do I know about the topic already?

You should always actively assess your purpose for reading and then vary your technique to suit your purpose.

Take an active approach to reading!

² [Source: Waters & Waters, 1995]

2.2 EFFECTIVE READING TECHNIQUES

When you are reading for information, you want to locate the information **as quickly as possible**. So, first ask: What kind of information do I need?

READING TECHNIQUE	TYPE OF INFORMATION REQUIRED
Skimming	Main ideas (the 'gist')
Scanning	Specific information
Intensive reading	Very detailed information/ meaning

1. SKIMMING (the fastest reading speed)



- use when you read a text for the first time to get a general picture or 'gist'
- use to pick out the main points **rapidly**

HOW?

- read the introduction and conclusion of the text
- read headings of sections
- read first lines of paragraphs

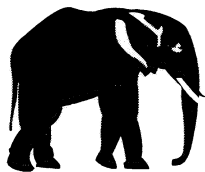
2. SCAN READING (reading at average speed)

- use to extract specific information
- serves as preparation for intensive reading once you have decided the article is relevant
- do not worry about parts of text you have difficulty with, concentrate on the parts with the required information

HOW?

- prepare search questions before you start reading
- prepare a list of key words that you want to focus on
(words or phrases that express the core of your research)
- search for key words and relevant information only
- do not read every word

3. INTENSIVE READING (the slowest reading speed)



- use for detailed analysis
- for an investigation and deeper understanding of the writer's opinion and attitude
- to read critically and evaluate articles objectively
- this should be done after first skimming or scanning the text

HOW?

Read in-depth and still use your time effectively by following these four steps:

STEP 1: Scan read to answer the following questions

- Why was this article written? Is the article's purpose to inform, to educate or to persuade?
- For whom was the article written? Is it for specialists, managers, businessmen or the general public?
- What is the article about? Give a one-line summary of its contents.

STEP 2: Re-read slowly, making sure you understand every sentence

- Underline every word you do not understand and discover its meaning.
- Make brief notes as you go of important ideas or facts relevant to your study.
- Underline any possible quotations.

STEP 3: Evaluate the piece

- Has the author formulated a problem/issue?
- In a research study, how accurate and valid are the measurements? Is the analysis of the data accurate and relevant to the research question? Are the conclusions validly based upon the data and analysis?
- Does this article contribute to our understanding of the problem under study, and in what ways is it useful for practice? What are the strengths and limitations?

- How does this book or article fit into the question I am developing?

Try to always ask yourself questions like these for each book or article you are reviewing: it will enable you to read critically and evaluate articles objectively.

STEP 4: Write your own review

- Write a summary of the contents. Include any relevant quotations and scan related visuals.
- Write about what you discovered from reading the book or what interested you the most.
- Think about any possible or practical applications of what you have read to your own work or to your country.

And one last technique, ...

Sometimes you have those 'emergency' situations where you just have to read a long text very quickly. In that case you might want to try this:

Speed reading

1. **Read only the topic sentence of each paragraph.**
 - If any seem particularly relevant, make a note in the margin and go back to it later.
2. **Put your index finger or pen at the left margin (edge of page) and only read the first word or two of each sentence.**
 - Only slow down to read a sentence if it contains one of your key words, and then skim the surrounding text for any further references. If possible, highlight or underline that section.
 - Skip over definitions and explanations of terms which you already understand.
 - Concentrate! Don't be distracted from your purpose.

INFORMATION SEEKING FOR LITERATURE STUDY

What should you do first? _____

Journal Articles

What is the first thing you should look at? _____

What do you do with it? _____

What do you look at next? _____

Books

What is the first thing you should look at? _____

If a chapter may be interesting, what do you look for? _____

Now you have finally found a large piece of interesting, relevant text. How should you read it?

Concentrate on scan reading **as quickly as possible** and noting sources only. Remember your purpose! Gather as many possible sources of information as you can relating to your specific topic/ideas. Intensive reading comes later.

Process of *reading* for literature study

1. Scan read most relevant books and articles
2. Make notes on source cards
3. Select best sources and select some sections to read intensively

2.3 WRITING SOURCE CARDS

Once you have found the information you need, it is helpful to keep an accurate record of *where* you found it. A good idea is to put them on small filing cards (8x12 cm). The advantages of this are:

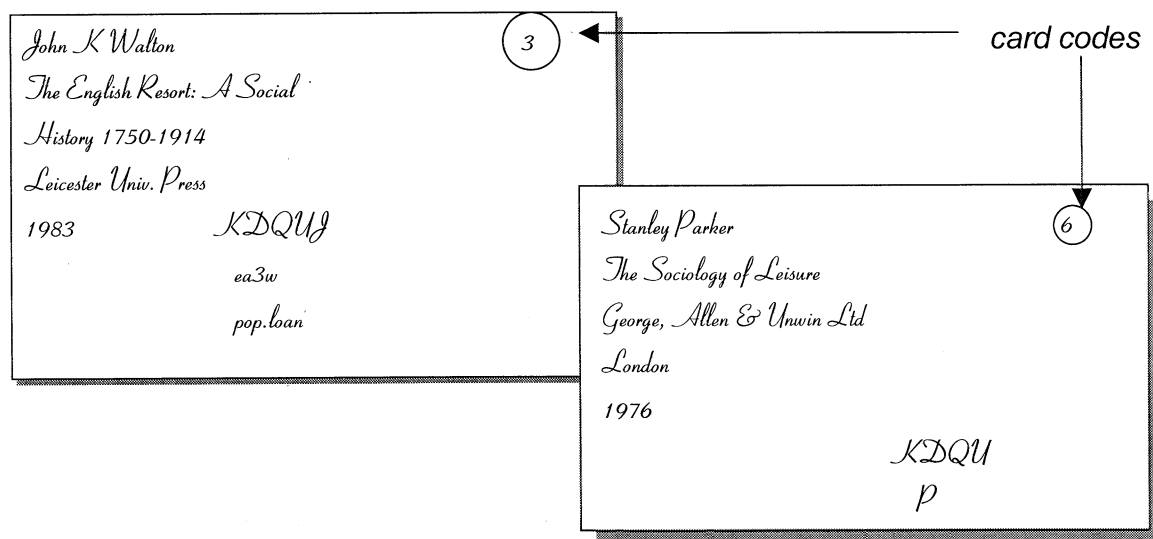
- it is easy to select and alphabetise the references you have actually used
- you don't have to sort through bits of paper, notes, teacher handouts etc
- you don't need to go back to the library to search for the reference

Note: source cards are different from notes: they only contain bibliographic information. Notes contain detailed information from the source. You should develop a **card code** to match source cards to your notes.

TASK³

Look at the two sample source cards, discuss:

1. What information is given (or omitted) on each card, and why?
2. What system do you use at the moment? Have you had any problems with it?
3. Do you think you would find using cards for source references helpful? Why or why not?



If you find it useful, you can also make a one or two sentence summary of the contents of the book/article on your source card.

³ [Source: Waters & Waters, 1995]

2.4 COPING WITH UNKNOWN WORDS

However good your English is, you will probably always find some unfamiliar words or grammar structures.

The meaning of unknown words which are important to understand can often be worked out using knowledge you already have (that means without a dictionary!). However, there will be times when using a dictionary is the best course of action.

The key is to adopt a **flexible approach**, using the most appropriate strategy for each problem.

TASK

Go through the following text quickly (ie. without trying to understand it's meaning) and underline all the words you do not know.

Water Retention Forces

What are the forces that lift water in the soil column against the force of gravity? The most important force is the vertical component of surface water tension. This force is also known as capillary force, because the phenomenon of capillary rise of water is also observed in capillary tubes.

The force depends on the radius of the capillary and will be larger in fine granular material like

loam than in a coarse porous medium such as sand or gravel.

Apart from the capillary force, the attraction of solids and their exchangeable ions for water (adsorption) also contribute to the retention of water in the soil. The combined effect of all forces exerted by the soil matrix is called matric force.

Exercise

- a) Imagine you want to use this article for an essay on 'Soil Moisture and Infiltration'. Now look at it again and answer these questions.
1. Which of the words you underlined is it essential to understand?
 2. Of these words, which of them can you work out the meaning of?
 3. Which of the words do you feel you need to look up in the dictionary?
- b) Discuss your reasons for the way you grouped the words. What strategies did you use to deal with the words you worked out the meaning of? How did you work out the meanings? Did you use any of the following strategies?
- checking to see if the word is defined in the text
 - looking for similarities with words in your own language
 - working out the meaning from the other words in the text
 - looking for how the words fit into the organisation of the ideas in the text

Did you use any other strategies? How effective were they?

Strategies for coping with unknown words

- Whenever you come across a new word, first try to find an informal definition of it somewhere in the immediate surrounding text.
- If you encounter a word not defined in the text, look at other words nearby for hints as to its possible meaning.

Example 1: What do you think **blowouts** means in this text:

*Everyone is familiar with newspaper accounts of the shoreline damage oil causes. The damage occurring year by year on different coasts results from **blowouts** at offshore drilling stations as well as from ships.*

Example 2: What does **tallied** mean in this text:

*A solar flux radiometer measured the energy reaching each level of the atmosphere from the sun. Two other devices also **tallied** heat radiation*

- Try to determine the word's grammatical function. Is it a noun, verb, adjective, or adverb?

Vocabulary building

- Try to get to know words well, especially ones important in your field of research. This means learning what they mean, how they are used, spelled and pronounced, and what their related forms are.
- Reading intensively is the very best way to acquire new vocabulary, since you will retain words learned in a meaningful context best.

Remember, every time you stop to look up a word in the dictionary you not only lose concentration and waste time, you also lose the total picture of what the article is about.

But by using the different clues within the text, you can gain an adequate understanding of the word, and you will be more likely to use it correctly in future because you have learned it in context.

3 MODES OF SCIENCE WRITING⁴

There are many different forms of writing in science and technology. When preparing a particular writing task, you will need to keep the needs of a particular **audience** in mind. You should ask 'Who am I writing this *for*?'. You will also need to think about **purpose** — does this writing seek to inform, to report, or to persuade? Finally, you will need to think about the **structure** of what you write. How can the sections, paragraphs and sentences best be organised?

3.1 THE FACTUAL ACCOUNT

One of the most familiar types of writing in science and technology, the factual account presents well-established information about a particular subject, explaining the underlying science at a level appropriate for its audience. You (the writer) are usually reporting what is known and generally agreed, rather than trying to give your point of view. For example:

Transport plays a major role in saving lives on Western Australian roads through its co-ordination of state road safety strategy and policy, and through promotion of road safety issues.

The number of fatalities and serious injuries has been steadily declining, both in real terms and in terms of deaths per 100,000 people. The 226 fatalities on Western Australian roads in 1998 represented approximately 12 people per 100,000 in the population, compared with approximately 35 people per 100,000 population in 1970.

*Transport's Office of Road Safety provides leadership, advice, expertise, research and administrative support to the state's co-ordinated road safety effort.*⁵

Here, the style is fluent and the writer proceeds logically from one point to another. The text is factual but not overly technical (although some basic knowledge is required to understand some terms, eg *fatalities*). So, the writer has an *audience* in mind with a particular level of knowledge and sees a particular *purpose* to the article.

**Factual accounts explain the essential core of a subject,
pitched at an appropriate level**

⁴ [Source: Northedge et al, 1997]

⁵ [Source: <http://www.transport.wa.gov.au/roadsafety/index.html>]

3.2 REPORTING OBSERVATIONS AND EXPERIMENTS

There are many publications in science and technology such as journals which publish papers and letters that report the latest findings in research. These are so rich in specialist jargon and make so many assumptions about how much readers will already know that they are notoriously inaccessible to 'outsiders'. Clearly, *audience* and *purpose* here are very different from factual accounts.

Research papers usually use a set type of *structure*. Typically, sections are headed, eg

- *Summary (or Abstract)*
- *Method*
- *Results*
- *Discussion, etc.*

In reporting what has been found through observations and experiments the personal element is usually reduced by using forms of the passive voice. For example:

"...three pads of blotting paper *were placed*..." rather than
" *I placed* three pads of blotting paper ..."

**When writing up practical work,
you will need to follow a standard structure**

3.3 ARGUING A POINT OF VIEW

Not all science writing should be devoid of the voice and opinions of the writer. Much lively and inspiring writing involves constructing an argument. Persuasive and logical argument involves much more than simply saying what you believe — your assertions (claims) have to be supported by evidence (proof). Scientific writing of this type aims to *persuade* by rational argument and is structured accordingly: clear statements supported by facts.

**Arguments put scientifically consist of
clear assertions supported by agreed facts**

3.4 THE PROFESSIONAL REPORT⁶

Introduction

Technical reports are read by a variety of audiences:

A good report responds to these reading patterns in two ways:

1. Use of structure:
2. Use of pattern:

STRUCTURE OF THE SHORT INFORMAL REPORT

- FOREWORD
(or INTRODUCTION) For all readers, particularly managers and non-specialists
 - SUMMARY
-

- DETAILS or
DISCUSSION Essential supporting arguments or proofs for expert readers
-

- APPENDICES Non-essential, or disruptively long, supporting information
-

⁶ [Adapted from Huckin & Olsen, 1991]

1. The Foreword and Summary: organising main points for non-specialist readers.

The Foreword and Summary always come _____ of a technical report, because their purpose is to orient readers of varying backgrounds.

The Foreword focuses on:

The Summary succinctly presents:

OUTLINE OF FOREWORD AND SUMMARY IN TECHNICAL REPORT OR MEMO

FOREWORD		SUMMARY	
Purpose	Type of information	Purpose	Type of information
Catch attention	<i>Why</i> was project done <i>Why</i> is it important for managers Problem statement	Present main results	Results in non-technical terms
Indicate information supplied in report: i.e. the subject of the report	<i>What</i> was done	Present information needed for decision making	Recommendations & their implications
Orient reader to the report	<i>Where</i> to find what, overview of report contents		

The Foreword (or Introduction)

1. The Foreword should catch the audience's attention by placing the report in its larger context, explaining why the project is important and defining the problem addressed in the report in terms the reader can understand.
2. The Foreword should briefly orient the reader to the subject of the report by explaining what type of investigation or action was undertaken in response to the problem.
3. The Foreword should focus the reader on the report itself, and help him to anticipate not just the contents but also the structure of the report, so that he has a 'road map' to guide him in perusing your report.

The Summary

1. The Summary should present the main results of the project and the main recommendations of the writer(s) *in brief*.
2. Its purpose is to enable managerial readers make decisions, so it tells what the writer has discovered or done, the implications of these findings or actions, and the recommendations that the writer will make, based on his expertise.

Here are the type of questions that a managerial reader will have about a project:

- *What is the project's importance to the company? What is its scope of application?*
- *What will it cost?*
- *Are any problems projected because of it?*
- *Are there any implications for the company - more work to be done, new resources/personnel required, priorities changed?*
- *Are there any important dates or deadlines associated with it?*
- *Are there any special recommendations for future action which the writer can make on the basis of his specialist knowledge?*

It is important that you try to address these questions, because you know more about the answers than anyone else.

As a technical expert, you may be employed to discover solutions and present data, but perhaps more importantly, to ***analyse and evaluate*** it for non-specialist, managerial readers as well as fellow specialists.

KEY POINTS

Foreword	focuses on the problem contains same information as an introduction, but is — shorter — more general
Summary	gives main results and recommendations focuses on the solution
Abstract	contains all the elements of a foreword and a summary, put together in one short piece of writing

2. The Discussion: structuring proofs for the technical reader

The overall Report structure moves from claims, contained in the Foreword and Summary sections, to proofs contained in the Details or Discussion section.

Within the Discussion itself, _____

ORGANISATION OF PROOFS FOR THE EXPERT READER IN A DISCUSSION

MAIN CLAIM(S)	Aerated lagoons show superior performance and costs
SUPPORT	Support
CLAIM 1	Aerated lagoons show better performance
<i>Sub-claim 1</i>	<i>Aerated lagoons show superior BOD reduction</i>
<i>Proofs</i>	<i>Table 1, discussion of statistics</i>
<i>Sub-claim 2</i>	<i>Aerated lagoons show superior organic loading potential</i>
<i>Proofs</i>	<i>Performance comparison, using statistics</i>
CLAIM 2	Aerated lagoons are less expensive
<i>Proofs</i>	<i>Table 2, discussion of costs</i>

Note how this structure works in the sample report, outlined in the following two pages.

In conclusion then, the Discussion must also be organised to convince both critical fellow specialists as well as the interested managerial reader. Note that the Conclusions and Recommendations section will usually reiterate what was said in the Summary, except that it is written in more technical language and will also include the most important proofs.

Short Informal Report: Structural organisation, movement from generalizations and claims to data and support

To: Ms J Jones, Director
Orange Grove Products
1135 Halifax Building
Orlando, Florida 32105

From: Leo Ming Chen, Environmental Engineer
Camp, Dresser & McKee Inc
One Center Plaza
Boston, Massachusetts 02108

Date: 29 February 2000

Subject: Citrus Processing Waste: Treatment System Proposal

Foreword

In your letter of 7 January 1999, you asked me to suggest a treatment process for the wastewater from your new citrus processing plant. You stated that any treatment process selected should

1. exhibit performance effectiveness under average and adverse flow conditions
2. exhibit cost superiority in terms of initial cost and yearly spending

Consequently, I have compared several treatment alternatives using the data you have supplied and your criteria as a basis for comparison. The purpose of this report is to recommend a process for economically and efficiently treating citrus processing wastes.

Summary

An aerated lagoon is recommended as the most efficient and economical method for treating citrus processing wastes. Several treatment processes were considered in the selection. These include the activated sludge process, the anaerobic lagoon, and the aerated lagoon. The advantages of the aerated lagoon over the other treatment processes are as follows:

1. The aerated lagoon is the only alternative which could meet federal pollution standards under adverse flow conditions. It exhibits significantly better performance under all conditions through more consistent BOD reduction and higher organic loading potential.
2. The aerated lagoon affords significantly lower initial and yearly costs due to its ease of construction, operation, and maintenance. Per lagoon, the estimated initial cost is only \$114,000 and the annual operating cost \$22,800, approximately half as expensive as the more economical of the other two options.

1. Performance Superiority of Aerated Lagoons

Aerated lagoons consistently produce a better-quality effluent than do activated sludge processes or anaerobic lagoons. Aerated lagoons exhibit better BOD reduction and higher organic loading potential under both average and adverse flow conditions that do either of the other treatment schemes.

1.1 Superior BOD Reduction by Aerated Lagoons

The standard for BOD, as published in the Federal Register of 1 February 2000, states that all discharges into receiving streams shall contain no more than 30mg/liter of BOD. Table 1 shows aerated lagoons with 95% BOD reduction potential to be capable of producing an effluent in compliance with federal standards under both average and adverse flow conditions. Activated sludge processes and anaerobic lagoons, on the other hand, can only effectively treat waste waters of average BOD values.

Table 1 BOD REDUCTION COMPARISON OF TREATMENT PROCESSES

Secondary Treatment System	BOD Reduction (%)	Effluent BOD of Average Strength Flow (mg/liter)	Effluent BOD of Maximum Strength Flow (mg/liter)
Aerated Lagoon	95	9.5 (OK)	28.2 (OK)
Anaerobic Lagoon	88	22.8 (OK)	79.2 (unacceptable)
Activated Sludge	85	28.5 (OK)	99.0 (unacceptable)

1.2 Superior Organic Loading Potential of Aerated Lagoons

Seasonal shockloads typical of citrus processing plants are easily handled by aerated lagoons but tend to pose problems for activated sludge processes and anaerobic lagoons. Production within the plant will be a one-shift-a-day operation and may shut down completely on weekends and holidays. The volume of wastewater therefore will fluctuate throughout the harvesting season, which begins in October and ends in June. A brief performance comparison of how these three systems react to such periods of high loading will show the distinct advantage which aerated lagoons have over the other processes.

- A **Aerated Lagoons:** Aerated lagoons, because they are not continuous-flow processes, can store wastewater until it can be treated. These lagoons can therefore be designed to handle a shockload of unlimited quantity.
- B **Anaerobic Lagoons:** Anaerobic lagoons also exhibit the same storage capabilities as aerated lagoons. However, because of the nature of anaerobic organisms, obnoxious odors are produced at high organic loadings. Hydrogen sulfide and mercaptans are produced at loading values exceeding 240-320 kg BOD/1000 cubic meters, a value very typical of the size of plant in question.
- C **Activated Sludge:** Activated sludge processes can only tolerate organic loading values not exceeding 260-340 kg BOD/1000 cubic meters. Higher loading rates were followed by bulking primarily caused by *Sphaerotilus* organisms.

2. Cost Superiority of Aerated Lagoons

Table 2 shows that aerated lagoons cost less than activated sludge systems and anaerobic lagoons in terms of initial capital as well as operational and maintenance (O&M) costs. The initial capital and O&M costs are usually reflective of the amount of equipment required for each system. Aerated lagoons require only turbine-type aerators and therefore cost very much less to build and maintain than activated sludge systems, which need several settling basins and numerous pumps. anaerobic lagoons, although not needing any equipment, have a higher operating cost than aerated lagoons because of the chemicals required in stabilizing the anaerobic bacteria. the estimated cost of these various systems is based primarily on average flow and BOD loadings. More detailed cost tables appear in the Appendix.

Table 2 COST COMPARISON OF TREATMENT PROCESSES

Secondary Treatment System	Cost (\$ thousands)	
	Capital	Annual
Aerated lagoon	114.0	22.8
Anaerobic lagoon	212.0	44.8
Activated sludge	725.0	39.0

3 Conclusions and Recommendations

My objective in this report was to recommend a process for economically and efficiently treating the citrus wastes from the new Orange Grove Products plant. The use of an aerated lagoon is recommended if the ultimate process is to produce an effluent which consistently complies with federal standards. Such a system will also save initial capital as well as annual operational and maintenance costs.

3. Conclusions And Recommendations

This section appears at the end of the Discussion section and should move from generalisations or claims to data and support.

1. It might include the most important technical results which led to the conclusions and recommendations and it could include technical details too complex for the average managerial reader.
2. It contrasts with the summary or abstract in that it assumes a higher level of technical expertise on the part of the reader.
3. The conclusions and recommendations section usually presents, in list form, a **technical summary** of what has been presented in greater depth in the development section of the Discussion.
4. It is important that it be carefully written, since for many readers it will be among the first sections they examine.
5. Make sure to cast all of the items in these extended lists in **parallel grammatical form**: this will make them look like the work of a precise, careful, technical professional.

TASK

On the following two pages, compare the two texts from the same report. The first is a set of conclusions and recommendations, the second is a summary. How are they different?

Conclusions and Recommendations

Conclusions: Six test wells were drilled, four of which penetrated sand and gravel suitable for developing adequate municipal wells.

1. The relationship of geologic units encountered in Test Wells 1 through 6 is interpreted and presented in Plate 1 (not included here). Two aquifers were identified: an extremely thick aquifer was encountered in Test Wells 2, 5, and 6 ranging in thickness from 78 to 125 feet, and a deep aquifer was encountered in Test Well 1 extending from 150 to 185 feet. There is theorized to be limited hydraulic action through fine-grained units between the two aquifers. Some degree of connection between the deep aquifer and upper aquifer was established by the rapid rise in water levels in Test Well 1 observed during a heavy rain in September 1998.
2. A conservative estimate of the yield from the upper aquifer is 2.0 mgd. Aquifer data indicate this could be produced by pumping any combination of two wells among Test Wells 2, 5, and 6 (assuming manganese in Test Well 2 proves acceptable). Ultimate production from a French Creek well field could prove to be in the 3.0 to 5.0 mgd range.
3. It is difficult to estimate the maximum production available from the lower aquifer encountered in Test Well 1 because this unit was not identified in the other five test wells. Based on the data from the pump test of Test Well 1, the yield of the lower aquifer is estimated to be 0.5 to 1.0 mgd.
4. The water quality from all wells is good, with the exception of the anomalously elevated manganese found in Test Well 2. Iron and manganese were present in all other wells but in acceptable concentrations. If there is a source of manganese (none has been identified to date) in the immediate vicinity of Test Well 2, there is concern that due to the extremely high permeability of the aquifers, the high manganese groundwater could migrate toward the other wells with long-term pumping. Typically the water is moderately hard to hard, with hardness ranging from approximately 7 grains in Test Well 1, to 10 grains in Test Well 5, to 14 grains in Test Well 2.

Recommendations: Based on results from drilling and sample analysis, the following tests and land purchases are recommended.

1. A short pump test (8 hours) should be conducted on test Well 2 to recheck the iron and manganese concentrations in this well.
2. In order to stress the aquifer as heavily as possible and simulate municipal well field operation, a pump test should be conducted on Test Well 6 with an attempted pumping rate of 700 to 1,000 gpm for 48 hours.
3. In order to secure the existing test wells, provide a buffer around these wells, and permit some aquifer test drilling, it is recommended that the township purchase property roughly rectangular in form extending 800 feet north and 800 feet south of Test Well 1 and west to the abandoned railroad tracks. This would be approximately 40 acres. If obtaining this acreage is not feasible, then it is recommended that, at a minimum, the township obtain property extending 800 feet north and 800 feet south of Test Well 1 and 600 feet to the west of Test Well 1. This would be approximately 22 acres. It is also recommended that a long-term option be obtained on the Barco property south of Test Well 2 and southwest of Test Well 3 for potential long-range future well field development.

Summary

We conducted studies and six test drillings to locate an area in which a reliable, high-quality, municipal water well field could be developed. We have located such a site.

Results: Four of the six wells drilled were productive and penetrated sand and gravel suitable for development of municipal wells. Each of the four productive wells showed very good water-producing capability, yielding 300 to 500 gallons per minute. further, the wells produced water of generally excellent quality, though with a potentially high but treatable concentration of manganese. One test well showed manganese concentration now high enough o require treatment, and there is concern that manganese levels in all the wells might increase to such a level. However, this would not prevent development of the well field, and additional study will be required to determine if manganese removal is necessary at all.

Conclusions: Production wells completed at the test well sites should more than supply the township's current and future needs. Analysis of test data indicates that such production wells could produce over 2 million gallons per day, twice the township's projected requirements. further, if the water-bearing sand and gravel are as extensive as we project them to be, yields of up to 5 million gallons per day could conceivably be developed.

Recommendations: We recommend that the property tested be acquired for development as a municipal well field. the property is unique in its supply capability within Milton Township, and a well field on this property should meet any present and foreseeable water requirements within the township.

Elements of the Technical Report

The report most frequently written by engineers, research scientists and other technical professionals is the research or lab report. Although research reports can take many forms, most contain the following major sections:

Cover and title page. This creates the reader's first impression of your report. It should be clearly typed, perhaps including a diagram but do not try to make it too fancy with borders, stars, or similar treatments. It should look neat and the title should concisely tell the reader exactly what the report is about.

Abstract. The abstract is an informative, concise statement of the work performed, its objectives and scope, and the major conclusions reached.

Table of contents. This lists every section heading and subheading and the page number on which they appear. Tables, figures, charts and graphs should be listed separately.

Introduction. This tells readers the purpose of the report. It provides background material, theory, and explanation of why the work was done and what it accomplished. It should:

- present the nature and scope of the investigated problem (problem statement)
- explain the importance of the research (significance)
- discuss findings from previous research and other related literature
- state the method of investigation
- present the key results of the research

The main body. The main body of the report can contain several sections (or chapters) depending on the nature of the work done. These can include: Literature Review; Method and Materials; Results; and Discussion.

Conclusions and recommendations. The conclusions are a series of numbered statements showing how the results answered questions raised in the stated purpose of the research (ie, referring back to the introduction). On the basis of the results and conclusions, the researcher can make recommendations about whether further research is needed or how the results can be applied commercially.

References. An alphabetical (on surname) bibliography listing all the technical literature used as research and reference material.

Appendices. Any sample calculations, tables, mathematical derivations, sets of measurements, calibration data, or computer printouts that are too long or too unimportant to be included in the main body of the report.

NOTE: The report sections shown in this chapter are typical, but the order in which they are presented can vary, and one or more sections may be omitted, depending on the length and complexity of the report. Furthermore, it is common for companies to use a particular format or 'house-style' for their reports. Always check with your supervisor or publications department to check if your organisation has guidelines for technical reports.

3.5 REFERENCING⁷

Referring to literature

The list of references or bibliography is an ordered list (usually at the end of your report) of **ALL** literature used, consulted or quoted from, in a traceable form. In drawing up this list, there are strict conventions for the layout and sequencing of references. The key is to choose one style and **stick to it!**

There are two main methods of referencing: the **Harvard Method** and the **Numeric System**:

- The **Harvard Method** puts a short reference in the text next to the quotation, paraphrase, etc. Usually, this is the author's surname (no initials or title!), followed by the year of publication; one or both items are placed inside brackets. The full references are then given at the end of the essay, article, etc – in *alphabetical* sequence.
- The **Numeric System** involves putting a small number in the text next to the quotation, etc. The full reference is then given as a footnote at the bottom of the page, or at the end of the essay, article, chapter or book – in *numerical* sequence.

Note: There is no one right way to write a reference list: different disciplines use different conventions. Use the method your tutor or department recommends or use one that is found in a leading journal in your field.

Citations in the text

Citations in the text should point the reader to the correct reference in the reference list in order to obtain full information on the cited work. **NB All references made in the text should appear in the list of References and vice versa.** Usually, all that is mentioned in the text is the author's last name(s) and the year, for example:

- a Pritchard (1963) states that "An estuary is a semi-enclosed body of water which has a free connection with the open sea and within which sea water is measurably diluted with fresh water derived from land drainage".
- b Chaotic systems may be identified as having small differences in the initial conditions which then produce great differences in the final phenomena. Therefore, a small error in the former will produce an enormous error in the latter, making prediction impossible (Poincaré, 1913).
[NOTE that the full stop always comes *after* the reference]

For tables or figures, insert your reference directly underneath like this:

[Source: Pritchard, 1963]

⁷ [Adapted from Jordan, 1997]

The list of References: some examples

books

Format: author, year, *title*, publisher, place of publication

Barry, R.G. 1992. *Mountain Weather and Climate*, Routledge, London

Brookes, A. and Grundy, P. 1990. *Writing for Study Purposes*, Cambridge University Press

(For three or more authors: it is necessary to list **all** the authors.)

second or subsequent edition:

Turabian, K. 1973. (4th ed) *A Manual for Writers of Term Papers, Theses and Dissertations*, University of Chicago Press

edited volume:

Sopper, W.E. and Lull, H.W. (Eds) 1967. *Forest Hydrology*, Oxford University Press

no obvious author or editor:

British Council. 1980. *The Teaching of Listening Comprehension*, ELT Documents Special, The British Council, London

proceedings

Format: name or society/association/etc, year, *title*, publisher

ASAE, 1988. *Modelling Agricultural, Forest and Rangeland Hydrology. Proceedings of the 1988 International Symposium, Chicago, Illinois*, American Society of Agricultural Engineers

a paper in proceedings or edited collections

Format: (if not already mentioned in bibliography) author, year, title. [In:] author, year, *title*, publisher, page numbers

St John, M. 1988. Attitudinal changes to self-access in EAP. In: Brookes, A. and Grundy P. (Eds) 1988. *Individualisation and Autonomy in Language Learning*, ELT Documents 131, London, Modern English Publications/The British Council: pp 126-135

Format: (if already mentioned in bibliography) author, year, title, [In:] author, year, page numbers

Haan, C. T. 1988. Parametric uncertainty in hydrologic modelling. In: ASAE, 1988: pp 330-346

articles in journals

Format: author, year, title, *journal*, volume, issue, page numbers
(or: author, year, title, journal, volume, issue, page numbers)

Hyland, K. 1990. A genre description of the argumentative essay, *RELC Journal* 21(1): 66-78

theses

Format: author, year, *title*, type, institution

Speelman, H. 1979. *Geology, Hydrogeology and Engineering Geological Features of the Serayu river Basin, Central Java, Indonesia*, PhD thesis, Vrije Universiteit Amsterdam

reports and manuals

Format: author, year, *title*, type, number, organisation

Leavesley, G.H., Restrepo, P.J., Markstrom, S.L., Dixon, M. and Stannard, L.G. 1996. *The Modular Modeling System (MMS): User's Manual*, Open-File Report 96-151, USGS, Denver, CO

other

Unpublished conference paper

McGrath, I. 1991. *Text use in the language classroom*. Paper presented at 1st International Conference of LATEUM/MAAL, Moscow, September 1991

Lecture Notes

de Laat, P.J.M. 1995. *Hydrology An introductory course*. Lecture notes HH134/95/1, IHE Delft, the Netherlands
[NOTE: this is placed alphabetically under 'L' for Laat]

Citing Electronic Information

For detailed information on how to make references to sources found on internet, I recommend that you study the web pages of IFLANET, the International Federation of Library Associations and Institutions at this address:

<http://www.ifla.org/l/training/citation/citing.htm>

[Go to www.ifla.org and type in 'citing' in the search window]

Some examples from the ifla website follow

References from Internet: Examples

Basic Format:

(references section)

Author's Last name, First initial. date of publication or NO DATE, if unavailable. Title of article or section used [Number of paragraphs]. Title of complete work. [Form, such as online or CD-ROM]. Complete URL [date of access].

Online Journal Article:

(within text of thesis)

So-called "ethnic cleansing" is not specifically associated with armed conflicts, but may occur as politics in a country in turmoil (Preece, 1998).

NEVER LIKE THIS:

So-called "ethnic cleansing" is not specifically associated with armed conflicts, but may occur as politics in a country in turmoil (http://muse.jhu.edu/journals/human_rights_quarterly/v020/20.4jackson-preece.html). **PUTTING THE WEBSITE INTO YOUR TEXT IS UNACCEPTABLE!**

(in References list)

Preece, J. 1998 Ethnic cleansing as an instrument of nation-state creation: Changing state practices and evolving legal norms [25pp]. Human Rights Quarterly [Online serial], 20(4). http://muse.jhu.edu/journals/human_rights_quarterly/v020/20.4jackson-preece.html [1999, Jan. 3].

(Example 2)

Inauen, A., Hewel, J. & Leutwyler S. 1999. Intermolecular bonding and vibrations of phenol-oxirane [11pp]. The Journal of Chemical Physics [Online serial], 110(3). http://ojps.aip.org/journals/doc/JCPA6-ft/vol_110/iss_3/1463_1.html [1999, Jan. 3].

Online Magazine Article: (from ProQuest Direct)

Paul, A. 1998. Is this the face of Russia's future? [26 paragraphs]. Fortune [Online]. ProQuest Direct [1999, Jan. 12].

Note: The URL of articles retrieved from database searches such as the one above will not function in subsequent online sessions and should not be used. Use just the name of the database.

Online Newspaper Article: (from The Record Online)

Slater, E. 1999. Ex-wrestler sworn as governor [30 paragraphs]. The Record Online [Online]. <http://www.bergen.com/news/jesse05199901058.htm> [1999, Jan. 5].

Online Reference Book: (From Encyclopedia Britannica Online)

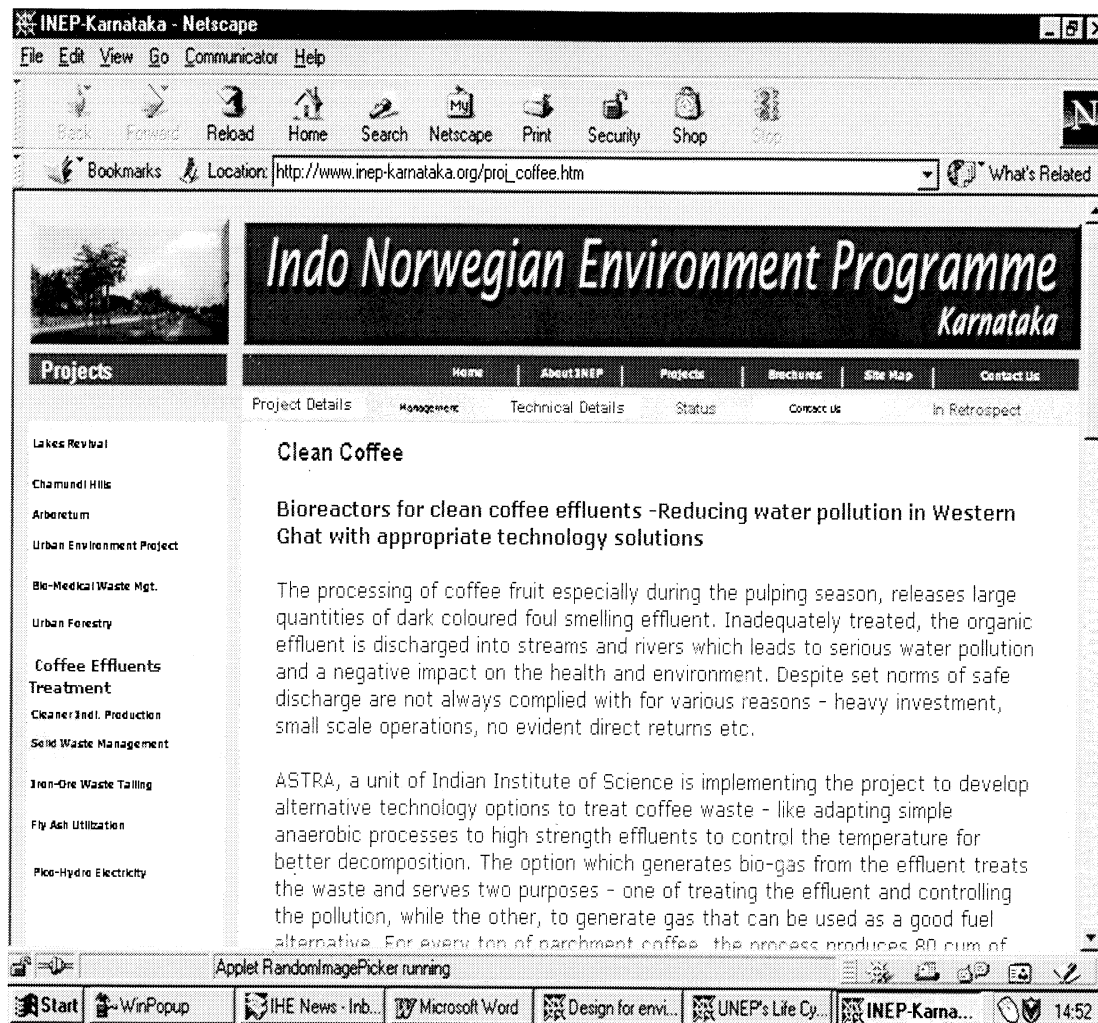
Prion. 1999. In Encyclopedia Britannica [Online]. <http://www.eb.com:180/cgi-bin/g?DocF=micro/481/90.html> [1999, Jan. 5].

Web Sites:

(from the WWW — no author)

NAACP 1998. NAACP image awards: 30 years of celebrating & 90 years of courage [Online]. http://www.naACP.org/image_awards/ [1999, Jan. 5].

EXAMPLES

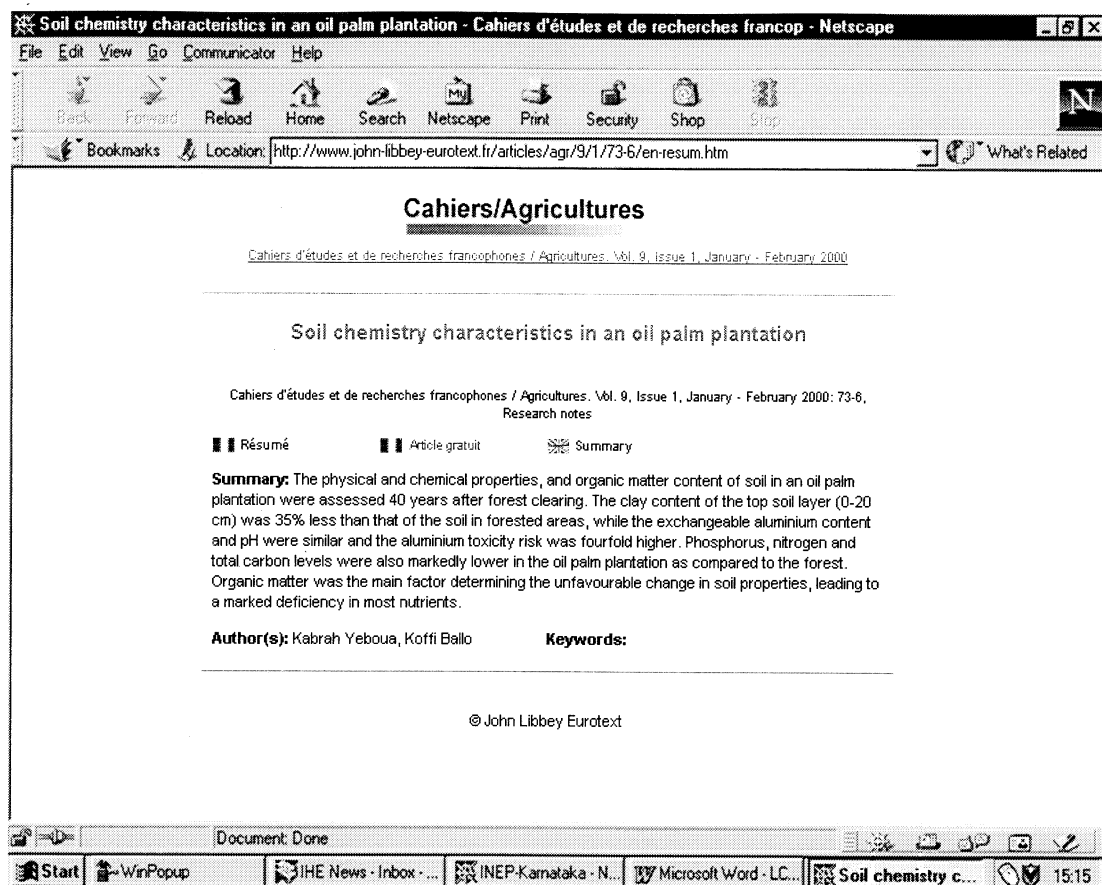


In text of report:

- Gas emissions: For every ton of parchment coffee, the process produces 80 m³ of gas that can be used as alternative fuel. (INEP, 2001)

In References section:

INEP, 2001. *Clean Coffee: Bioreactors for clean coffee effluents - Reducing water pollution in Western Ghat with appropriate technology solutions.* [5 paragraphs]
Indo Norwegian Environment Programme [Online] http://www.inep-karnataka.org/proj_coffee.htm [2002, Aug.26]



In text of report:

The physical and chemical properties and organic matter content of the soil in an oil palm plantation were assessed 40 years after forest clearing by Kabrah and Koffi (2000).

In 'References' section:

Kabrah Y., Koffi B., 2000. *Soil chemistry characteristics in an oil palm plantation*. [1 paragraph] John Libbey Eurotext [Online] <http://www.john-libbey-eurotext.fr/articles/agr/9/1/73-6/en-resum.htm> [2002, Aug.13]

The list of References

The most important rule here is that all literature cited in the main body of your report must be identified easily by the reader from the References list. Therefore, the reference in the text ***must be identical*** to the beginning of the reference in the References list. Also, the entries in the References list must be clear and complete so that others can retrieve the exact same piece of literature.

When you choose a style and sequence for formatting entries in your References, make sure this **pattern is consistent for every entry** throughout the whole list.

Example of a References list*

Billatos, Basaly (1997) Green Technology and Design for the Environment, Taylor and Francis, USA

Burall P (1991) Green Design, Bourne Press Limited, United Kingdom

Gandy (1994) Recycling and the Politics of Urban Waste, Earthscan Publications Ltd, London United Kingdom

Levy GM (2000) Packaging, Policy and The Environment, Aspen Publishers, USA

Sheng, Worhach (1998) A Process Chaining Approach toward Product Design for Environment, Journal Industrial Ecology Vol.1 No.4:36

Stilwell et al (1991) Packaging for the Environment: A Partnership for Progress, Arthur D Little Inc, New York USA

Tibor, Feldman (1996) ISO 14000: A Guide to the New Environmental Management Standards, Times Mirror Higher Education Group, Inc.Co, USA

TASK

Did you notice some errors in this list? What are they?

* copied from a participant's Literature Study, MEng 2001-2

FAQs (Frequently Asked Questions)

Q In reading a piece of literature, I have found an interesting quotation from another book (or article) inside it. How can I refer to it?

A *Put simply — you cannot! The rule is that you can only refer to works you have actually consulted yourself. However, you can hint to the reader that you are referring to a quotation within a book. Eg, you are reading a book by Smith, who refers to another work by Clark. You could say something like this:*

In his recent report, Smith (2001) refers to an interesting study which found that

Further, you could also include the exact page numbers in your reference list, thus showing any interested reader what you are actually referring to.

Q If a work has more than one author, how do I choose which name to use first?

A *Copy the way this has been done on the original book or article, ie take the first name given as it is written on the literature. It is not necessary to rearrange a group of joint authors into alphabetical order.*

Q What if I want to refer to more than one work written by the same author?

A *Place separate entries in your list of references in date order, starting with the earliest date. For example:*

Philips, J. 1982

Philips, J. 1986

Philips, J. 1993

Q What if I am using different pieces of work published by the same author in the same year?

A *Add suffixes a, b, c, etc to the date of publication. For example:*

In text

(Smith, 1994a)

(Smith, 1994b)

In References

Smith, A.L. 1994a

Smith, A.L. 1994b

Q Supposing a lot of my writing is referring to the same piece of literature. In the text, do I have to keep repeating the reference after each sentence, or each paragraph?

A *No. Try to group ideas from one book or article together and only put in the reference at the end of a group of sentences or paragraph. If you insert one or more paragraphs of your own ideas and then another paragraph referring to the same author again, you could use (Ibid), meaning 'in the same place'. This is only used to avoid repeating an author's name where the reference is from the same work as the immediately previous one. Use sparingly!*

4 WRITING SKILLS⁸

The section, **Starting Strategies**, dealt mostly, with the exciting, creative part of writing. Think great thoughts, work out your arguments and express them on paper. However, the keynote phrase for this section could well be:

Writing means rewriting

Here, we will look at some of the skills you need to develop in writing, but they are to be applied above all in the **revision** stage of the writing process. With practice, these techniques will become more familiar to you, and result in a more professional presentation of your work.

- 4.1 USING PARALLELISM
- 4.2 WRITING PARAGRAPHS
- 4.3 READABILITY
- 4.4 CONNECTIVES
- 4.5 EDITING FOR EMPHASIS
- 4.6 PUNCTUATION

⁸ [Some materials adapted from Huckin & Olsen, 1991]

4.1 USING PARALLELISM

Writing consists of both **form** and **content** (*how* you organise your writing as well as *what* you are actually writing). When you write so that the form reflects the content, it greatly enhances the readability of your text: it helps readers to follow the logic of your argument with ease.

One major way of using form to signal content is to use parallelism in the writing of lists.

TASK

To illustrate, let's look at the following two formatted lists of things to do. Which one is using parallelism?

LIST A

Mail needs to be picked up
Call Hazlitt
Tailgate project
\$\$\$ from RJ - don't forget

LIST B

Pick up mail
Call Hazlitt
Work on tailgate project
Ask RJ for \$\$\$

The following sentence also includes a list, although it is unformatted. What are the items on the list? How can you tell?

Evidence that the receptor sites on the membrane can serve both for metabolite transfer and for metabolite signalling has raised many questions as to the mechanisms of membrane information transfer.

Parallelism, then, exists when two or more sentence elements of equal importance are expressed in the same (parallel) grammatical form.

1. Types of list

A list may be defined as any set of two or more items having a co-ordinate relationship. As the following examples indicate, there are different types of lists. In fact there are three main types: formatted, semi-formatted and unformatted.

1. Some lists are fully formatted, as in this company memo:

- a) Government invoice #79-1018A
- b) Bonded stores invoice #31285
- c) DECAS letter 5/20/99

or:

- Government invoice #79-1018A
- Bonded stores invoice #31285
- DECAS letter 5/20/99

As you can see, a formatted list uses *both* vertical alignment and alpha-numeric sequencing (or bullets) to signal a co-ordinate relationship between the items.

2. Semi-formatted lists use one of the two markers, that is, *either* vertical alignment *or* alpha-numeric sequencing, but not both. Which is used in the following example?

Factors taken into consideration include the following: 1) size of lot, 2) parking requirements, 3) need for elevator, 4) cost per gross square foot, and 5) expected annual return per gross square foot.

3. Unformatted lists use none of these markers, therefore, parallelism plays a much more important role: it clearly marks a list that would otherwise be very difficult to identify.

Compared to standard bipolar types, VMOS transistors offer higher input impedance, faster switching times, wider operating range, and smaller chip area.

Whatever type of list you use, it should always be written in **parallel grammatical form** in any case. This will make your content clearer, save your reader unnecessary work, and make your writing tighter and more professional looking.

Using parallelism all the time is a very good writing habit to cultivate

2. Creating parallelism

Many times, only simple changes are necessary to make a list parallel. Compare the following two lists of waste water treatment processes.

LIST A

The principal processes are:

1. Coagulation and flocculation
2. Removal of solids
3. Removal of nitrogen
4. Disinfection

LIST B

The principal processes are:

1. Coagulating and flocculation
2. Removing the solids
3. Nitrogen-removal
4. Disinfection

Instead of mixing verb forms (*-ing*) and noun forms (*-al*, *-tion*), list A uses only noun forms which results in a much sharper list.

Sometimes it is useful to include **prepositions** and other small words in order to make unformatted lists parallel. What has been added in the revised version of the following example? What are the items on the list?

1. The purpose of this report is to present evidence that the contracting officer acted within the range of his authority and his final opinion was binding.
2. The purpose of this report is to present evidence that the contracting officer acted within the range of his authority and that his final opinion was binding.

Too often, writers construct part of a sentence in one way and switch to another construction later in the same sentence. When parallelism is violated in this way it can lead to misinterpretations of your writing by busy readers.

1. This filter has two important functions: to reject impulse noise signals and passing low frequency command signals without amplitude or phase distortion.
2. This filter has two important functions: to reject impulse noise signals and to pass low frequency command signals without amplitude or phase distortion.

By putting the two key verbs in parallel form, the writer has created a much clearer second version: there is no need to re-read the sentence this time!

Exercise 1

Each of the following contains a list that lacks parallelism. Without changing the meaning, can you make small changes to improve these lists using the principles of parallelism?

- A** The building is 140 feet in length, 78 feet wide, and has a height of four stories.
- B** Test results indicate that soil 1 is likely to settle, since high plasticity is equivalent to highly compressible.
- C** In Florida, where the threat of hurricanes is an annual event, we learned that it is important to become aware of the warning signs. There are precautions to take, and deciding when to take shelter is important.
- D** The widest employment of DDT is in the control of insects of public importance (as a mosquito larvicide, a spray for malaria eradication, and to control typhus by dust application).

The benefits of parallelism are many: an economy of words, a clarification of meaning, a sense of symmetry, and a sense of the equality of each idea in the sentence.

The previous sentence is an example of parallelism!

3. Misleading parallelism

Given that readers use parallelism, subconsciously, to perceive lists, it is important *not* to use it when there is *no* list. Otherwise, comic misinterpretations may result.

Richard Clarke, Senior Systems Programmer, asked me to develop a magnetic tape management system, to reside permanently on the computer, to give better control, and to co-ordinate the numerous magnetic tapes.

The parallel use of infinitives, (to develop, to reside etc), makes it appear that a four item list is being presented:

Richard Clarke, Senior Systems Programmer, asked me:

- a) to develop a magnetic tape management system,
- b) to reside permanently on the computer,
- c) to give better control, and
- d) to co-ordinate the numerous magnetic tapes.

In cases like these, the writer needs to break the misleading parallelism and only present those items which do, in fact, constitute a list, in parallel form. In this example, the last three items form the real list:

Richard Clarke, Senior Systems Programmer, asked me to develop a magnetic tape management system:

- a) which will reside permanently on the computer,
- b) which will give better control, and
- c) which will co-ordinate the numerous magnetic tapes.

This can be further revised by omitting *which will* apart from in the lead-in:

Richard Clarke, Senior Systems Programmer, asked me to develop a magnetic tape management system, which will reside permanently on the computer, give better control, and co-ordinate the numerous magnetic tapes.

Exercise 2

Each of the following passages contains misleading parallelism. Correct each passage by making appropriate grammatical changes.

- A My present occupation is repairing typewriters, printing machines, and duplicating machines.
- B You learn many reasons why our product failed by reading, observing, talking, and listening to our salespeople.
- C This technology consists of three methods of scrambling, which are the coupling of light source and optical fibre in low-order mode, splicing, bending and tightening the fibre near its connectors, and installing the scrambler into the existing fibre optic in intervals of 1 km along the route.

4.2 WRITING PARAGRAPHS

Most readers of technical writing read rather selectively and rapidly. Therefore, you need to make your writing as easy to read as possible, even if you are explaining complex material. One of the best ways to do this is to write paragraphs effectively.

What makes for a good paragraph in technical writing?

- 1.
- 2.
- 3.

There are two principal tools you can use to develop clear paragraphs:

You need to a) write a

and b) use a

Topic statements

A topic statement should

- 1.
- 2.
- 3.
- 4.

Look at how this works in the example below.

Unlike gasohol-powered cars, the fuel cell alternative is virtually pollution-free. A methanol fuel cell system works through chemical reactions that leave the air clean. A fuel processor breaks the methanol down into carbon dioxide and hydrogen; the hydrogen is then pumped to the cell itself, where it combines with oxygen to form water. Current is then produced when the electrons traded between molecules in this reaction travel through an external circuit. The net products are carbon dioxide, water, and electricity. By contrast, when gasohol is burned in an internal combustion engine, it produces the same nitrous oxides that gasoline does.

What is the topic of this paragraph? Can you describe the pattern of development that is followed?

Let's now look at another example: what is this paragraph about?

Utility costs for the argon process are 75% greater than for the proposed hydrogen process. Initial capital cost is \$5.4 million, roughly three times the hydrogen process cost. However, annual income from the sale of argon, increased ammonia production, and reduced natural gas requirements elsewhere in the plant is 160% higher than that generated by the hydrogen process. Present-worth analysis shows that the argon process is the better investment. The present worth of the argon process is \$10.25 million. The present worth of the hydrogen process is \$4.14 million.

On the basis of the first two sentences of this paragraph, which process would you think is being recommended? Where is the topic statement? How do you think this paragraph could be improved?

What do you think of this improved version?

The argon process is clearly a better investment than the hydrogen process. Although it has higher utility costs (by 75%) and a higher initial capital cost (by 300%), it generates annual income - from the sale of argon, from increased ammonia production, and from reduced natural gas requirements elsewhere in the plant - that is 160% greater than that generated by the hydrogen process. Present-worth analysis shows that the argon process is valued at \$10.25 million. The hydrogen process, by contrast, is valued at only \$4.14 million.

Now the topic statement is at the beginning, so that the message of the paragraph is consistent and clear.

The basic principle behind a good topic statement is this:

Read the following topic statement.

1. The human body is made up of millions and billions of cells, each of which contain among other substances, millions and billions of protein molecules.

What do you think the rest of the paragraph will be about? Do you expect it to elaborate on other substances, cells or the human body in general? What pattern of organisation do you think it will follow? Comparison and contrast or classification and division? Which do you think is most likely and why? Let's see what happens...

2. An average cell contains hundreds of different kinds of proteins, and all of the cells of the human body contain, among them, as many as 100,000 different kinds of proteins. These proteins can perform millions of different functions, a versatility which is largely responsible for the phenomenon called 'life.'

Now, a paragraph rarely exists in isolation. A pattern may be continued into the following paragraph, or the break may be used to establish a new pattern. In any case, continuity needs to be maintained. Look at how the writer of the membrane transport article does this with the opening sentence of the next paragraph.

3. The proteins derive their versatility from their structure -- they are made up of chains of molecules of amino acids, substances of which there are 20 different ones in the human organism'

What is the topic of this paragraph? What kind of pattern do you think it will follow? Does the rest of the paragraph meet these expectations?

4. An average protein molecule consists of about 500 molecules of amino acids of different kinds (seldom all 20), arranged in some particular sequence. A sequence of 500 amino acids composed of all the 20 different ones would have as many as 1×10^{60} (1 followed by 60 zeros) possible arrangements, each arrangement having particular chemical properties and therefore chemical capabilities. From these few facts alone, we can easily appreciate how important the study of the amino acids is to our understanding of proteins, of the cell, and of life.

A topic statement should introduce the topic of the paragraph and set up the reader's expectations for what is to come

Typical patterns of organisation

The pattern of organisation you use should follow naturally from your topic statement. The reason for using a pattern is to organise supporting information in a lucid, easily understood way.

Typical patterns used in technical writing are:

- **chronological description**
- **cause-and-effect analysis**
- **comparison and contrast**
- **listing**
- **general-to-particular ordering of details**

By using the features characteristic of each pattern, you will make it easier for your reader to follow.

1 Chronological description

Uses:

Characteristic features:

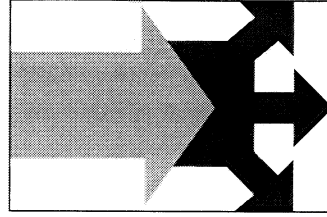
Which of these features appear in the following sample paragraph?

Total US research and development spending *is projected* to reach a current dollar level of \$66.7 billion *in 1981*. This is an increase of 10% over *the 1980 projected level* and nearly double the amount spent on these activities *in 1975*. Even in constant dollars, US R&D spending *in 1981 is expected to follow* the growth trend of *the past five years, when* R&D funding grew at an average annual rate of better than 3%. That growth resulted in large part from increased emphasis on searching for means to resolve energy and environmental problems and a resurgence of defence R&D activity. *Between 1975 and 1978*, the last year for which survey data are available, energy *accounted for* one-third of the R&D spending increase while, at the same time, amounting to 10% of the national R&D effort.

As you can see, the use of _____ neatly organise the details in what could have been a somewhat confusing paragraph.

2 Cause and effect analysis

Uses:



Features:

Here's a good example of cause-and-effect analysis in use.

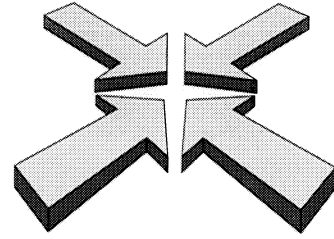
One of the most important properties of a liquid is that its surface behaves like an elastic covering that is continually trying to decrease its area. A *result* of this tendency for the surface to contract is the formation of liquids into droplets as spherical as possible considering the constraint of the ever-present gravity force. Surface tension arises *because* the elastic attractive forces between molecules inside a liquid are symmetrical; molecules situated near the surface are attracted from the inside but not the outside. The surface molecules experience a net inward force; and *consequently*, moving a surface molecule out of the surface *requires* energy. The energy E required to remove all surface molecules out of range of the forces of the remaining liquid is proportional to the surface area; *therefore*,

$$E = \sigma A$$

Note the use of _____ in a step-by-step sequence.

3 Comparison and contrast

Uses:



Characteristic features:

Note how these features are used in the following example.

A one-million-fold increase in speed characterizes the development of machine computation over the past fifty years. The increase results from improvements in computer hardware. In the 1950s ENIAC, an early electronic computer, filled a room with its banks of vacuum tubes and miles of wiring. Today, one can hold in the hand a computing device costing about \$200 that is twenty times faster than ENIAC, has more components and a larger memory, is thousands of times more reliable, costs 1/10,000 of the price, and consumes the power of a light bulb rather than that of a locomotive.

The use of _____ clearly mark this comparison and contrast pattern.

4 Listing

Uses:

Characteristics:

Which method is used in this example?

In addition to coal and nuclear energy, a wide variety of other power sources are frequently discussed in the news and in scientific literature; unfortunately, most are not yet ready for practical use. Geothermal energy is one of the more practical of proposed new sources. It is already in use in Italy, Iceland, and northern California but is not yet meeting all expectations for it. Solar energy seems an elegant idea because it is inexhaustible and adds no net heat or carbon dioxide to the global environment. Yet present methods of exploiting it make solar energy hopelessly inadequate as a major power source in the next few decades. Sophisticated windmills to generate electricity are also under study by some. Biomass conversion is also getting under way. Some of these sources of energy, which we now generally regard as esoteric, may well prove themselves and make a substantial contribution over the long run if their costs can be brought within reason.

Finally, if the items on the list are not of equal importance, arrange them either in descending or ascending order of importance, but let the order be clear!

Signal words will help, eg:

First and foremost...

Last but not least....

Last, but most important(ly)...

5 General to particular ordering of details.

Uses:

Features:

Magnetic bearings have been developed for aerospace applications, but only recently has their practicality been demonstrated as the heart of energy storage systems. The breakthrough is partly due to the recent development of stronger permanent magnets, such as those made from rare-earth cobalt compounds. Only ten pounds of such magnets could support two tons of rotor. Although the free suspension of a weight with permanent magnets is an unstable condition, an electromagnet servo loop has been used successfully to stabilize the rotor position.

Other patterns

Many other patterns are possible, for example: based on classification and division, an extended definition, or an example. Sometimes, more than one pattern may be combined in a paragraph. However, do try to use one main pattern as the structural backbone of a paragraph.

EXERCISE 1

For each of the following paragraphs, circle an **appropriate** topic statement from among the three possibilities given. Be prepared to defend your choices.

- A**
1. *Coal is a more viable source of energy than petroleum*
 2. *The quantity of coal left in the earth is impressive.*
 3. *The mining of coal entails a number of difficulties.*

There are known to be 198 billion tons of coal at a depth of less than 1000 feet and lying in beds at least 3.5 feet deep for bituminous coal and at least 10 feet thick for beds of lower grade coal. An equal quantity of coal at the same depth is identified as "undiscovered reserves." In addition, there are even larger quantities of less available coal resources, amounting to 1 trillion, 400 billion tons. At 35 million Btu's per ton, coal can provide a great deal of energy for many years to come.

- B**
1. *Many molecular biologists believe that the discovery of movable genetic elements will help solve several long-standing mysteries.*
 2. *There are approximately 50,000 genes in the human body.*
 3. *In eucaryotes, the genes coding for protein production does not exist as one continuous stretch of DNA.*

It seems to go a long way, for instance, toward explaining how the human body is able to synthesize a million and more different molecular antibody species, each tailor-made to grapple with a specific antigen. Movable elements may help answer the age-old question of differentiation: how a fertilized egg divides and ultimately becomes, in the course of embryonic development, many different kinds of tissue cells. Jumping genes may also provide a mechanism for satisfying scientists who have been arguing that point mutations alone were far from enough to account for the story of evolution.

EXERCISE 2

Each of the following sentences has been taken from an original text where it serves as an effective topic statement for a well-written paragraph. See if you can guess roughly how each paragraph is developed beyond the topic statement: what the key words are, what general strategy the writer uses.

- A** The first modular home to be tested by government engineers for durability exceeded the criteria for the National Bureau of Standards.
- B** At the time of its explosion, Mount St. Helens was probably the most closely watched volcano in the world.
- C** The production of an important heavy chemical, nitric acid (HNO₃) requires large quantities of ammonia.
- D** Until 1922, no-one knew how a signal crosses the junction between one nerve cell and another.
- E** The basic property of gyroscopic action is that the gyroscope stays spinning in exactly the same direction in space over both short and long periods of time.

4.3 READABILITY

Readability could be defined as the ease with which a document can be read. And although this is a writing course, its whole emphasis is on learning to write for your reader. After all, the art of communication does not lie just in speaking or writing well, but in making sure that you are understood. Writing therefore involves constantly asking questions of yourself, so that you can put yourself 'in the reader's shoes' at all times.

With this understanding of the term readability, let us look at some principles about how to order information so that it can be easily understood, in both small and large-scale pieces of writing.

Information ordering

A basic principle behind all effective technical writing is this:

Put information that is *new* to the reader into a framework of information *already known* to the reader.

To apply this principle, the most important question to ask is: Who will read my writing? What do they know about the topic? In writing and especially revising your work, you must always keep your audience in mind.

Compare the following two passages for level of readability: How does the second passage differ from the first? Which one is easier to understand? Why?

1. Modern cryptanalysis has attracted some of the most capable mathematical minds. In recent years the fact that postal and diplomatic communication is being replaced by other forms of communication has further motivated mathematicians and engineers to invent an unbreakable cipher (secret code). Messages can be telephoned, transmitted, and quickly delivered to the receiver. But unbreakable codes will be needed to protect senders against snoopers.
2. Modern cryptanalysis has attracted some of the most capable mathematical minds. In recent years the fact that postal and diplomatic communication is being replaced by electronic communication has further motivated mathematicians and engineers to invent an unbreakable cipher (secret code). Electronic devices permit messages to be telephoned, transmitted, and quickly delivered to the receiver. But unbreakable codes will be needed to protect senders against electronic snoopers.

These examples illustrate one way to apply the 'known-new' principle. Secondly, the use of **appropriate, evocative key words in prominent positions** in your text will greatly enhance coherence and readability. The following example clearly illustrates this.

□ **BUILDING SECTIONS AND PARAGRAPHS AROUND KEY WORDS RELATED TO THE MAIN TOPIC**

Reach out and touch

Cell-cell junctions come in a variety of shapes and sizes

When **cells** come together — and stay together — they do more than just *touch*. *Contiguous cells* actually form highly specialized, highly organized **interconnective structures**. And with the development of a technique called freeze fracture, a method for separating the inner face of a membrane from its outer face, scientists have managed to extract many details about the micro-architecture of these fine **intercellular contacts or junctions**.

One of the earliest known of the **intercellular junctions** is the revet or weld-like **desmosome**. *Adjacent cell* membranes *linked* by way of **desmosomes** don't actually *touch*; the *neighbouring* surfaces are separated by a space of about 200 angstroms. (One angstrom equals one hundred-millionth — 10^{-3} — of a centimetre.) And the space is packed with dense, extracellular

material, which serves as *binder*.

Desmosomes have been found primarily between the *cells* of sheetlike epithelial tissue, which covers the surface of the body and the internal surfaces of most organs. A variation of the **desmosome**, the half-desmosome, does not link cells to other cells but anchors individual cells to the underlying mesh of connective tissue between the epithelium and the underlying organ. According to Norton B. Gilula of Rockefeller University, an authority on *intercellular junctions*, the function of **desmosomes** is now thought to be strictly that of *adhesion* — to keep tissues and organs intact despite mechanical stress. That belief is prompted in part by the fact that *cells* normally subjected to severe, repeated stress — heart muscle, for instance — possess unusually large numbers of *desmosomes*.

[From Ben Patrusky, *The Social Cell*, Mosaic 12(4):9 (1981)]

Some guidelines for easy-to-read writing

1. Make it clear what the main topic of each chapter or section is. Then state your purpose explicitly, so that readers can anticipate how you will be dealing with the topic. (cf. Developing an outline, in section 1.1.)
2. Build sections and paragraphs around key words related to the main topic. As far as possible, make these key words prominent by using them in titles, headings, subheadings, topic statements and sentence subjects. See how this was done in the previous article.
3. When writing for non-specialists, be sure to clarify the important concepts in your text by giving definitions examples, analogies, or using visual aids. Also, avoid technical terms when a simpler word will do, or when a term's meaning may be unclear to a large portion of your readers, eg⁹:

The moon was in syzygy. —————> The moon was aligned with the sun and the earth.

Maximize the decibel level. —————> Turn up the sound.

4. When writing for fellow specialists, on the other hand, use standard terminology; if a technical term makes your writing clearer, use it!

internal software programs that run the computer system operating system

small-scale test version of a larger industrial process pilot plant

5. Structure your text so as to give the greatest prominence to the most important information. Put your main ideas up front, don't bury them in the middle somewhere. That's where you can list supporting details for the interested reader.
6. Construct well-designed paragraphs. (This is discussed in more detail in the section 'Writing paragraphs')
7. Field test your writing, (on a good second draft), with its prospective readers, or representative substitutes. Have them mark it up, raise questions, criticise it. Then revise accordingly.

⁹ [Source: Blake & Bly, 1993]

4.4 CONNECTIVES: SIGNPOSTS TO UNDERSTANDING

What are connectives?

The most important aspect of connectives is their meaning; when used properly, they signal logic and guide the reader through the reasoning in a text. However, unless they are properly grammatically used, they can still confuse rather than facilitate the reader.

◆ Meaning

Basically all connectives can be divided into three broad categories of meaning:

- 1) AND (also, moreover, similarly, etc)
- 2) OR (rather, alternatively, instead, etc)
- 3) BUT (however, nonetheless, etc).

◆ Grammatical usage

Grammatically speaking connectives can be divided into two categories:

A Conjunctive adverbs (thus, however, etc.)

This first set are used to link sentences and clauses, which could also make perfect sense standing on their own. They are usually used at the beginning of sentences, but can also come in the middle or at the end of the sentence.

B Subordinating conjunctions (since, although, etc.)

This second set can only be used in clauses *dependent* on a main clause for meaning, thus, they cannot be used in single clause sentences and must be used at the beginning of their dependent clause.

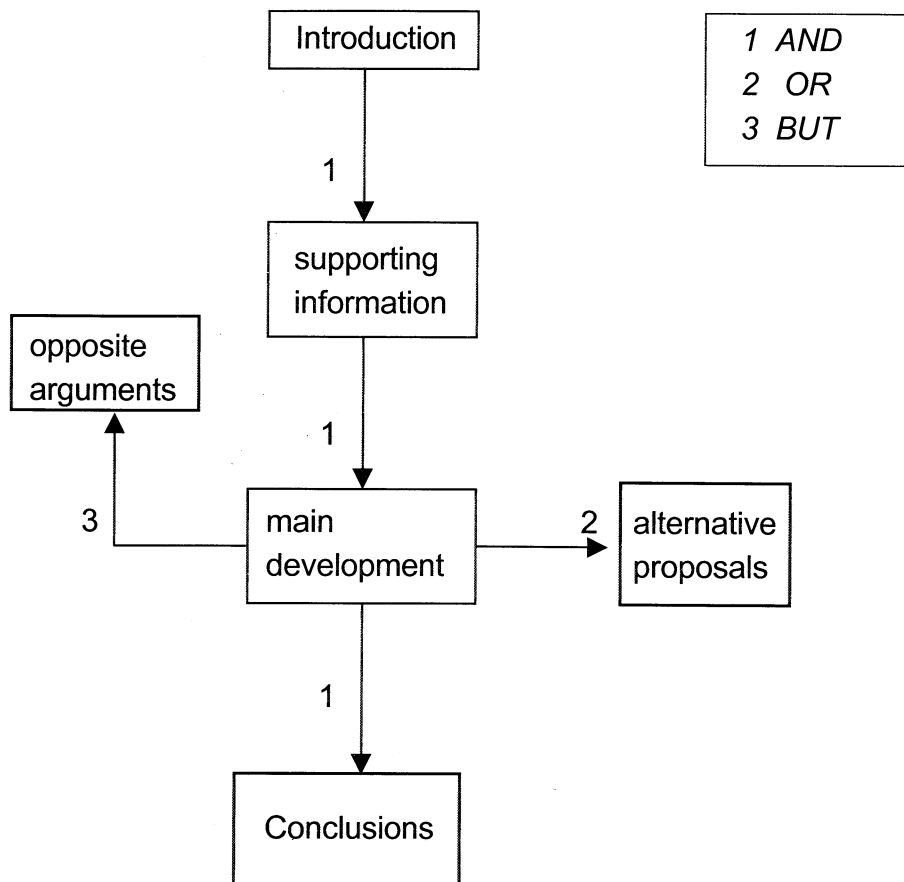
Example of subordinating conjunctions:

WRONG *Since researchers are independently funded. They can be relied on to do unbiased research.*

RIGHT *Since researchers are independently funded, they can be relied on to do unbiased research.*

1 Connectives in Use

A piece of writing or text will often have the following structure:



1. The discussion, argument, or comment in the development of the topic may be very straightforward, in which case ideas will be added together one after the other. The basic connective 1 'and' is used here. (A number of connectives have a similar or related meaning to *and*.)
2. Sometimes the comments may be expressed in another way, or an alternative proposal may be made. This is represented by the basic connective 2 'or'. (A number of other connectives have a similar meaning.) After the alternative has been considered, the main argument will continue.
3. There are also occasions in arguments etc. when the opposite is considered or referred to. This is represented by the basic connective 3 'but'. (There are also a number of other connectives with a similar meaning.) After the opposite or opposing view has been considered, the main argument is continued.

2 Connectives in Grammar

As was mentioned in the introduction, it is important to understand the correct grammatical usage of these connectives. The following list, with accompanying exercises is designed to help you in this direction. First come the conjunctive adverbs, which should be used to join independent clauses together.

A. EXAMPLES OF CONNECTIVES IN USE (*conjunctive adverbs*, for linking independent clauses)

THEREFORE, THUS, consequently,
as a result, so (informal)

Combustion catalysts consist of various shapes of basic material with a metallic compound. The variety of shapes and catalytic materials provide a multitude of catalysts for each application. *Therefore*, a good general rule to follow is to consult with a catalyst manufacturer on the most suitable catalytic equipment configuration.

HOWEVER

At one time the atom was believed to be the ultimate unit in the subdivision of matter. Subsequently, *however*, it became known that the atom is composed of still smaller units.

FOR EXAMPLE, for instance

Variation is a very important characteristic of data. *For example*, if we are manufacturing bolts, excessive variation in the bolt diameter would imply a high percentage of defective product.

FIRST, ... SECOND(ly), ...
THIRD(ly), ... FINALLY

A further elaboration of these facts falls naturally under two headings. *First*, what are the quantitative relations between irradiation dosage and genetic damage? *Second*, to what dosages are people being exposed?

IN ADDITION, FURTHERMORE,
moreover, besides [informal]

All organic compounds, in principle can be ranked according to their relative ability to undergo photochemical reactions characteristic of smog. For many, however, the data are not available. *Furthermore*, the ranking of a number of organic compounds on the basis of their rates of disappearance during photolysis would not necessarily be the same ranking of those same compounds on the basis of their ability to produce eye irritation.

ON THE OTHER HAND	The increasing price of oil may cause a shift to coal in many countries. Worldwide, coal should last for at least 300 years. Oil, <i>on the other hand</i> , will be virtually depleted within 60 years.
IN OTHER WORDS, that is	The chromosomes of higher organisms, including man, occur in pairs. <i>That is</i> , the genetic information found in any one chromosome is duplicated in another chromosome ordinarily identical in size and shape.
OF COURSE, naturally [informal]	There are two types of kettles used for cooking varnish: the open kettle, which is heated over an open flame, and the newer totally enclosed kettle, which is set over or within a totally enclosed source of heat. <i>Naturally</i> , the open kettle allows vaporized material to be emitted to the atmosphere unless hooding and ventilation systems are provided.
EVEN SO, NEVERTHELESS, nonetheless, still [informal]	Experiments on humans are essential; they have been the cornerstone of medical progress and will continue to remain so. <i>Even so</i> , many tests cannot be done on humans because of practically or propriety; certain tests would be outrageously costly or unethical.
as mentioned above (earlier, before), as shown in Figure ----	Conventional ultrasonic testing has its disadvantages: strong signals from one of the surfaces can mask the signal of a discontinuity near one of the surfaces ... [three paragraphs later] <i>As mentioned earlier</i> , conventional ultrasonic testing generally fails to clearly distinguish discontinuities close to the surface
IN GENERAL	The conversion of low-Btu gas to high-Btu gas entails the production of much CO ₂ , each molecule of which represents the waste of a carbon atom originally present in the coal. <i>In general</i> , for processes now under development, it appears that the production of low-Btu gas will have a thermal efficiency up to 20% greater than that of high-Btu gas.
IN FACT, indeed, as a matter of fact	Physics is far from being a solitary pursuit. <i>In fact</i> , physicists today interact intensely with each other.
IN PARTICULAR, SPECIFICALLY	It is the role of astronomy to ascertain the earth's probable future as determined by the action of cosmic forces. <i>Specifically</i> , astronomy must seek to discover what the prospects are for the earth's continuing as a suitable abode for life, and study those events which could end the existence of mankind.

actually, in actuality	Pythagoras was born in the year 569 B.C. on the island of Samos, off the west coast of Asia Minor. It is claimed that he travelled extensively throughout Egypt, Babylon, and the Orient, where he supposedly learned of their mathematics, religions, and mysticism. <i>Actually</i> , all we know for certain is that he had a good knowledge of the beliefs and mathematical concepts of the people of Asia Minor.
IN CONCLUSION, in summary, to conclude, to summarise	[after a two-page discussion of the "Synthetic Aperture Focusing Technique" as a new method of ultrasonic testing of materials] <i>In conclusion</i> , the SAFT UT system represents a significant improvement in modern methods of non-destructive evaluation. If continued funding by the NRC allows further research to proceed ...
in theory, in principle, theoretically	The problem with solar energy is that, although sunshine itself costs nothing, it takes ingenuity and money to capture it. <i>Theoretically</i> , 1 horse power can be generated on about 1 square yard of land under the best conditions. But such are the unavoidable losses that not fewer than 4 and probably as many as 10 square yards are needed to generate 1 horsepower.
in practice	If an experiment is repeated a large number of times, N, and event A is observed n times, the probability of A is $P(A) = \frac{n}{N} 1$ <i>In practice</i>, the composition of the population is rarely known and hence the desired probabilities for various events are unknown. But we ignore this aspect of the problem, since our aim is only to create a mathematical model.
INSTEAD, rather	The most striking feature of the cray-1 supercomputer is its simplicity. It does not use any sophisticated devices such as magnetic bubble memory or supercooled conductors. <i>Instead</i> , it uses only three types of integrated circuits: memory, logic and arithmetic.
IN COMPARISON, BY CONTRAST	Nuclear medicine differs from existing angiography procedures in that nuclear imaging is an emission effect caused by the emission of gamma rays from the decaying isotope. <i>In comparison</i> , angiography is a transmission effect caused by the transmission of X-rays through the patient, to be imaged on the opposite side.

if so, in that case	The age of the engineer as a specialists may have reached its zenith and may now be starting to recede. <i>If so</i> , the development and implementation of computer-aided engineering may re-establish the importance of the engineer as a generalist.
in most cases, generally, usually, for the most part	Large volumes of hydrocarbon gases are produced in modern petrochemical plants. <i>Generally</i> , these gases are collected and used as fuel or as raw material for further processing. Sudden or unexpected upsets in process units and scheduled shutdowns, however, can produce gas in excess of the capacity of the gas-recovery system.

B. EXAMPLES OF CONNECTIVES IN USE (*subordinating conjunctions*: for linking dependent clauses)

ALTHOUGH, though, while, even	<i>Even though</i> automatic computing is much faster and cheaper than it has ever been, there are still problems that cannot be computed owing to their size or complexity, at least not in a practical sense. <i>Though</i> a computer wades through a problem at 100 million steps per second, it may be in a losing race with the scientist applying his or her ingenuity to complex problems.
SINCE, BECAUSE, owing to	<i>Since</i> natural carbon contains approximately 1 percent C ¹³ along with 98.9 percent C ¹² , the average atomic weight of carbon is about 12.011 amu.
IF	The U.S. government considers computers to be strategic commodities with potential military applications. <i>If</i> an American firm wishes to export a computer, it must first obtain a license from the State Department (<i>if</i> the computer is intended for military use) or from the Commerce Department (<i>if</i> it is intended for civilian use).
in order for (that)	For combustion of organic vapors and liquids, the vapor and air must be within the limits of flammability. <i>In order that</i> a flame be self-sustaining, the mixture of air and combustible material must provide enough heat to maintain the combustion temperature.
rather than, instead of [-ing]	The "ideal system concept" is a simple idea that anyone can understand. <i>Rather than</i> use the models of the present trouble-ridden system as a guide for developing a recommended system, concept produces a model of the best or most ideal system as a guide.

COMMON MISTAKES made by non-native speakers when using connectives:

Using *actually* to mean "**currently, presently.**" Speakers of Spanish, French, and other Romance languages tend to make this mistake, since similar forms in those languages (Sp. *actualmente*, Fr. *actuellement*, etc.) do mean "currently, presently." *Actually* is closer in meaning to *in fact*. The only real difference is that *actually* is normally used to play down or correct an earlier statement whereas *in fact* is used to upgrade or magnify one.

Using *after all* to mean "**finally, in conclusion.**" This phrase means roughly "regardless of what might be said about it." It is used to emphasise the fundamental essence of something, not to signal the end of a sequence or the end of a discussion.

Using *although* and *but* in the same sentence. "Although I studied hard, but I only scored 56 on the exam" is incorrect. You can use either *although* or *but*, but not together.

Using *it* in idiomatic as phrases. Phrases such as "as was mentioned above" and "as is shown in Figure 12" are idiomatic and should be used as fixed forms, without an *it* subject "As it was mentioned above" is incorrect.

Using *comparing to (with)*. The correct connective forms are *compared to* and *in comparison with*. You can use *comparing* as a gerundive participle followed immediately by a direct object: "Comparing these latest results to (with) our earlier ones, . . ."

Using *conclusively* to mean "**in conclusion.**" *Conclusively* is the simple adverbial form of the adjective *conclusive* (= "decisive, supported by solid evidence"). It is not a connective.

Using *on the contrary* to mean "**on the other hand.**" *On the contrary* is properly used to deny some earlier statement, whereas *on the other hand* is used simply to present an alternative to some earlier statement. *On the one hand* and *on the other hand* are often used together to present a pair of alternative statements.

Using *particularly* to mean "**in particular.**" *Particularly* means "especially"; it is an ordinary adverb, not a connective.

EXERCISE Complete each of the following sentences with an appropriate line of development. (Do not worry about the factual accuracy of your answer; just provide a continuation that fits the given connective.)

- A Nuclear power plants do not produce chemical pollutants such as sulphur dioxide or PCBs. However, they
- B Synthetic fuels are difficult to manufacture. In fact,
- C White light appears to be devoid of any colour. In actuality, though,
- D More and more automobile engines are being built today that use fuel injection devices instead of carburettors. Nevertheless,

4.5 EDITING FOR EMPHASIS

One of the most common problems with academic/technical writing is that too many students spend too little time on editing. As you work on the final version of your report, you will want to edit unnecessary wordiness and rewrite any unclear, confused passages so that the main points stand out clearly.

There are several techniques we shall now consider which can be used to edit and rewrite effectively:

- **Cut repeated or redundant words/phrases**
- **Signalling and signposting**
- **Add intensifiers**
- **Be concise**

Careful use of these techniques will help to make your writing clearer and more easily understood.

1. Cut repeated or redundant words/phrases¹⁰

Some redundant words are modifiers that merely repeat an idea already contained in the word being modified. For example, many people use the phrase *very unique*. As *unique* means one of a kind, it is therefore impossible for anything to be *very* unique. Another example is *new innovation* — is there any such thing as an *old* innovation?

To spot redundancies in your writing, ask: does the word *add* meaning? Here are some examples of common redundancies:

actual experience
basic essentials
adding together

in close proximity
repeat again
past history

Exercise 1 The following paragraphs lack flow and emphasis because the sentences are all short and contain repeated information. Improve this by cutting out repeated words/phrases and combining those sentences that are most closely related.

- A The Cleveland Engine Plant will begin making diesel engines in 1992. The diesel engines will be produced along with the gas engines already in production. However, there is only one area for machining pistons. Both gas pistons and diesel pistons must be machined there.
- B The maximum speeds of the electric cars are much lower than those of the gas cars. The maximum speeds of the electric cars are barely fast enough to maintain freeway speeds. This causes problems with utilization of electric cars on freeways, and it almost limits their use to residential streets. The maximum speed must be increased to give electric cars a better chance for utilization.

¹⁰ [Some materials adapted from Blake & Bly, 1993]

2. Signalling and signposting¹¹

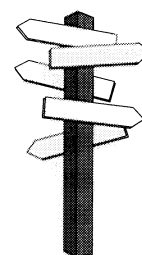
In order to follow your train of thought, the reader has to know what questions and issues to hold in mind; what direction you are heading in and why. To maintain a clear flow of argument for the reader, you must *signal* what is going on. One essential means of doing this is to use *linking* phrases which pass meaning from one sentence to another, and *signposting* phrases which tell where you are in the development of the argument. Some phrases perform both these functions at the same time.

Signal words / linking phrases

- conversely, furthermore, on the other hand, since, although, despite, specifically, not only ... but also, nevertheless

Signal words indicate to the reader the '*logical relationship*' or connections we intend between the ideas we present. Linking phrases take the reader from one sentence to the next. They show how to approach each new sentence, given what has just been said in the last one.

Signposting is reminding your reader from time to time where you have reached in the argument and pointing the way you are going. When used to open paragraphs, signposting phrases serve to sharpen the reader's focus on *what we have just been talking about* and, at the same time, signals a *new* direction to the argument. For example:



- In the previous section the influence of (X) was studied, which showed that In this section, on the other hand, the influence of (Y) will be studied to determine

Also:

- Before discussing (X) we must ask question (Y)
- Having considered the arguments against, we now ...
- A final set of issues we must take into account concern ...

Similarly, phrases can be used to draw ideas together:

- as we have seen
- in short

KEY POINTS

- Use linking phrases to carry the meaning forward from one sentence / paragraph to another
- Use signposting phrases to periodically remind your reader where you have got to
- Paragraphing is part of the signposting which shows the way through a report; readers will get lost if the signs are too far apart

¹¹ [Some materials adapted from Northedge, 1990]

TASK:

Identify signal words and their effect in the following passage:

The more-complete-expansion cycle is more efficient than the conventional diesel cycle. It uses the same four strokes but a relatively smaller combustion chamber. In its intake stroke, the intake valve closes when the piston is at some point A between TDC and BDC, thus drawing in less air-fuel mixture. The compression, power, and exhaust strokes are identical to those of the diesel cycle. However, since there was less mixture to start with and since the increase in volume due to the piston moving to BDC is the same, the temperature and pressure of the gases after the power stroke is over are lower. More of their energy has been utilized, thus increasing the efficiency of the cycle. The smaller combustion chamber is necessary because the temperature and pressure at TDC in the compression stroke must be high enough to cause combustion of the mixture. Since there is less mixture in the chamber, the mixture must be squeezed into a smaller volume to get the same temperature and pressure.

Note: It is not necessary to signal/signpost everything you do; it can become boring and overdone. In the end, you will have to make judgements about how much signposting your reader will find helpful. Remember it's best to err on the generous side — your ideas are rarely as obvious to your reader as they are to you!

3 Intensifiers

A useful tool to add emphasis to important points are intensifiers, ie adjectives and adverbs which amplify and strengthen the meaning of main verbs and nouns. Common scientific intensifiers are:

*significant(ly), considerable(ly), obvious(ly), easy(ily),
complete(ly), much, many, very*

Compare the following two passages to evaluate the usefulness of intensifiers:

1. Repairing the flyash returns is the optimal solution because of economic and downtime considerations. The three return units can be repaired by three of our employees with a downtime of two days and a cost of \$1,375, including labour. To have the units replaced would take two months' downtime and because of an limited staff, would have to be done by outside contractors at a cost \$70,000.
2. Repairing the flyash returns is the optimal solution because of economic and downtime considerations. The three return units can easily be repaired by three of our employees with a downtime of no more than two days and a cost of less than \$1,375, including labour. To have the units replaced, on the other hand, would take at least two months' downtime and, because of our limited staff, would have to be done by outside contractors at a cost of \$70,000 or more.

4 Conciseness

Be concise! Be economic and precise in your use of words. A wordy style is not more professional, in fact all it does is bewilder your reader. The following two versions of the same report were presented for comment to 74 scientists from the British Ecological Society. Which version do you think they preferred?

Brown's Version

In the first experiment of the series using mice it was discovered that total removal of the adrenal glands effects reduction of aggressiveness and that aggressiveness in adrenalectomised mice is restorable to the level of intact mice by treatment with corticosterone. These results point to the indispensability of the adrenals for the full expression of aggression. Nevertheless, since adrenalectomy is followed by an increase in the release of adrenocorticotrophic hormone (ACTH), and since ACTH has been reported (P. Brain, 1972) to decrease the aggressiveness of intact mice, it is possible that the effects of adrenalectomy on aggressiveness are a function of the concurrent increased levels of ACTH. However, high levels of ACTH, in addition to causing increases in glucocorticoids (which possibly accounts for the depression of aggression in intact mice by ACTH), also result in decreased androgen levels. In view of the fact that animals with low androgen levels are characterized by decreased aggressiveness the possibility exists that adrenalectomy, rather than affecting aggression directly, has the effect of reducing aggressiveness by producing an ACTH-mediated condition of decreased androgen levels.

Smith's Version

The first experiment in our series with mice showed that total removal of the adrenal glands reduces aggressiveness. Moreover, when treated with corticosterone, mice that had their adrenals taken out became as aggressive as intact animals again. These findings suggest that the adrenals are necessary for animals to show full aggressiveness.

But removal of the adrenals raises the levels of adrenocorticotrophic hormone (ACTH), and P. Brain found that ACTH lowers the aggressiveness of intact mice. Thus the reduction of aggressiveness after this operation might be due to the higher levels of ACTH which accompany it.

However, high levels of ACTH have two effects. First, the levels of glucocorticoids rise, which might account for P. Brain's results. Second, the levels of androgen fall. Since animals with low levels of androgen are less aggressive, it is possible that removal of the adrenals reduces aggressiveness only indirectly: by raising the levels of ACTH it causes androgen levels to drop.

To help you analyse the difference between these two writers' styles, answer *true* or *false* to the following statements. Cite examples to prove your conclusions!

1. Smith's style is more concise than Brown's.
2. Brown uses a simpler sentence structure, with shorter opening phrases
3. Brown uses unnecessarily technical terms.
4. Smith makes better use of signal words.
5. Brown's format is not as clear as Smith's.

From the following table you can see what the judging scientists felt about the two writers' styles.

	Yes, Smith (%)	Yes, Brown (%)	No Difference (%)
Does one author give the impression of being more competent?	31	12	57
Does one author seem to have a better organised mind?	73	3	23
Does one author seem to be more objective?	24	8	68
Does one author inspire more confidence in what is being said?	44	15	41
Does one author seem to have a more dynamic personality?	46	7	47

Creating Conciseness¹²

- *Use plain rather than elegant or complex language*

The technical writer should strive for simplicity by avoiding fancy and pretentious phrases. Plain language communicates more effectively than complex language, and clear communication — not literary style — is the mark of good technical writing.

Complex

I feel that the application of these key principles will provide me with a clear-cut method of handling problem situations, while affording the employee the opportunity, the experience, and the feeling of interacting with me.

Simple

The application of these key principles will give me a method of solving problems and allow me to work closely with the employee.

Another very important consequence of Einstein's theory of special relativity that does not follow from classical mechanics is the prediction that even when a body having mass is at rest, and hence has no kinetic energy, there still remains a fixed and constant quantity of energy within this body.

The corporation deemed it necessary to terminate Joseph Smith.

¹² [Some materials adapted from Blake & Bly, 1993]

- **Delete words, sentences, and phrases that do not add to your meaning**

Unnecessary words waste space and the reader's time, and they make strong writing weak. The fewer words you use, the better. After you have written a first draft, go through it with a pencil and strike out all words, sentences, phrases and pages that do not add to your meaning. Concise writing is livelier and more readable than wordy prose, for example:

Wordy

It is most useful to keep in mind that the term *diabetes mellitus* refers to a whole spectrum of disorders.

In the majority of cases, the data provided by direct examination of fresh material under the lens of the microscope are insufficient for the proper identification of bacteria.

Concise

Diabetes mellitus refers to a whole spectrum of disorders.

Often, bacteria cannot be identified under the microscope.

Exercise 3: The verb phrases in column A are typical of a wordy, noun-heavy style of writing. Use column B to provide one-word equivalents.

A

effect a reduction in
accomplish a modification of
come to the conclusion that
increase by a factor of two
give an explanation of
have a deleterious effect upon
create an improvement in
do an analysis of
make a recommendation that
focus on the comparison of
conduct an investigation of

B

reduce
modify

Exercise 4: The writing samples below can be made much more concise. Rewrite them, eliminating all unnecessary words.

- A At this point in time we are engaged in a re-evaluation of the budget.
- B The design that is recommended for adoption would accomplish the removal of particulates with the desired degree of efficiency.
- C According to our estimates, the cost of the system would be on the order of approximately \$1.2 million.
- D It is the purpose of this report to provide you with information about the current status of the no-smoking experiment.
- E In our judgement, the optimal course of action would be to maintain continued use of the cycle of first testing and then revising.
- F My telephone number is 221-3600 if you would like to contact me about any questions you might have pertaining to the contents of this report.
- G At our meeting of 9/4/99 we had a discussion about the fact that people have been making numerous complaints concerning vertical movement in the Hudson wing. The problem at hand was the excessive wait time people have been experiencing while waiting for the Hudson elevator.

- ***Break up your writing into short sections***

Remember that each paragraph should focus on one main idea. Readers like brevity, so look for ways to break long sentences and paragraphs into shorter, easier-to-follow units.

In any 50 or 60-word sentence, there is at least one opportunity to divide the sentence into two shorter sentences. A paragraph of 10 to 15 sentences might be broken into two or more shorter paragraphs by finding places where a new thought or idea is introduced.

In the same way, the whole text should be broken up into many short sections and sub-sections. Use headings and sub-headings to title each section. Each short section should be a self-contained mini-essay on a single idea or thought.

- ***Proper word choice***

Whenever you are reading through your own writing and have doubts about some aspect of the vocabulary, study the particular word(s) in question and ask yourself:

1. Is there a shorter, simpler, or more modern word that would make my meaning equally clear?
2. Will most of my readers understand the word?
3. Is the word as specific and concrete as it can be?

If the word is too complex, too long, unfamiliar, old-fashioned, vague, or abstract, search for another word that will serve you better.

4.6 PUNCTUATION

Punctuation marks serve as useful 'road signs' to a reader. They help the reader see the **grammatical structure** of a sentence and thus more easily grasp both the **meaning** of the sentence as a whole and the **relationships** between the sentence elements.

The most commonly used — and misused — punctuation marks in scientific and technical writing are:

- the comma
- the semicolon
- the colon
- parentheses
- dashes

Independent clauses

Three punctuation are used to indicate a close relationship between independent clauses:

- 1) Use a comma, if the clauses are joined by *and*, *but*, *or*

The pressure in a gas or in a liquid is different at points that differ in height, and properties that depend on the pressure are also different.

Computer-linked scanning devices have been developed for bubble chamber films, but they cannot function without human helpers.

- 2) Use a semicolon, if the two independent clauses are closely related (co-ordinate) to each other, but there is no linking word (co-ordinating conjunction):

The structure of a simple liquid such as argon or methane is determined primarily by the repulsive forces between molecules; the attractive forces act only as a "glue" that holds the fluid together.

There are many geometries that are different from Euclidean; however, only the elliptic and hyperbolic geometries are called non-Euclidean.

- 3) Use a colon if the second part of the sentence (clause) elaborates on, or explains the first:

All chemical equations should be balanced: they should show the same number of atoms of a given kind and the same net charge on each side.

The concept of randomness can best be explained by the use of examples: the sequence of heads and tails in tossing a perfect coin is said to be random.

Introductory Phrases (dependant clauses)

Use a comma to separate introductory (dependant) phrases from the rest of the sentence, and thus make it easier for the reader to locate the sentence subject:

Since most current plantings are transplants from the greenhouse and are several months old, they can tolerate stronger herbicides.

For the first time, volcanologists have pieced together a map of which settlements are most at risk from lava and mudflows.

Parenthetical Information

Three different marks can be used to indicate parenthetical (non-essential) information:

1) Use commas in most cases:

The so-called British system of weights and measures, which is now on its way out in Britain, has its roots in ancient history.

Galileo originally intended to be a doctor, on his father's advice that there was much more money in healing ailments than in proving theorems.

2) Use parentheses for references, abbreviations, definitions, qualifications, and other subsidiary information that may be of interest only to certain readers:

It has long been known that the vertebrate electroretinogram (ERG) consists of various components that have been ascribed to electrical sources located mainly in the receptor layer and in the inner nuclear layer of the retina.

3) Use dashes for emphasis (unless writing for conservative readers):

Mixtures can be categorized as either homogeneous — uniform in properties throughout the sample — or heterogeneous.

Many of the experimental methods of modern chemistry were developed originally by men and women regarded as physicists — for example, the methods of spectroscopy and those of structure determination by the diffraction of x-rays.

Lists

Unformatted lists — those not separated from the text — can be set off either by a colon, or by dashes, or parentheses:

1) Use a colon if the list ends the sentence:

The new technology is most widely known for its microelectronics: pocket calculators, microcomputers, and other products that have revolutionized information processing and communication.

To produce 100,000 Btus, one needs the following quantities of various fuels: 2 lb. of natural gas, or 5 lb. of petroleum, or 8 lb. of coal, or 1 lb. of wood.

2) Use dashes or parentheses if the list does not end the sentence:

Every aspect of the peptide neurotransmitters —how they are made, what they do, where and how they act, how they are disposed of, and even whether they are true transmitters or serve some other function —is being studied with great intensity.

The charge of an electron has been shown to occur in integral multiples (1, 2, 3, 4, etc.) of its basic value, therefore magnetic charges should also occur in integral multiples of some basic value.

To separate items of a list:

1) Use commas in most cases:

There are many words in our language that indicate sets: school of fish, swarm of bees, herd of cattle, squadron of planes, etc.

2) Use semicolons if the items are long or are punctuated internally:

We have assembly plants in the following locations: Cedar Rapids, Iowa; Totowa, New Jersey; Edmonds, Washington; and Castle Rock, Colorado.

An efficient project cost system must accomplish three important objectives: (1) check actual and projected costs of ongoing projects against the estimated cost; (2) obtain production rates for use in estimating new work and create historical files; and (3) forecast the project final cost.

In formatted, displayed lists, that is those set off from the body of the text, punctuation is optional:

*The positions available are
Recovery plant supervisor
Management analyst
Administrative aide
Clerk-typist*

*The positions available are:
Recovery plant supervisor,
Management analyst,
Administrative aide, and
Clerk-typist.*

5 PRESENTATION SKILLS

In many fields of technology, the ability to communicate orally is just as important as the ability to write well. Studies show that people in management positions rely more on oral communication than on written communication; in fact, the ability to communicate well orally is often of crucial importance in determining who gets promoted in the first place!

A survey done among engineers showed that of 30 specific job-related communication tasks, 10 of the most important were oral tasks, such as: project proposal presentations, project progress report presentations, etc. The purpose of this unit, therefore, is to provide some guidelines on how to give formal and informal presentations.

The three keys to giving successful presentations are:

1. Prepare properly;
2. Practice sufficiently;
3. Deliver your presentation with energy and enthusiasm.

5.1 PREPARATION¹³

Logistics: Begin by checking all the details you need to plan your presentation, include:

- the duration of the talk
- whether time for questions is included
- the size and location of the room
- the projection/lighting facilities provided

Projection and lighting facilities are particularly important to check.

Does the room have the equipment you need? Eg, slide projector, overhead projector, blackout curtains or blinds. Is it working? Is it in the right position?

Have a look around the room and try out the equipment not later than the day before your presentation, so you are able to use it with confidence.

Your talk: The most important thing to remember is that people have a limited attention span, and that you must therefore organise your talk very clearly so that the main points stand out. This is how you do it:

¹³ [Adapted from Huckin & Olsen, 1991]

a) **Analyse your audience and limit your topic accordingly.** What do your listeners already know? What do they need to know? How much information can they absorb?

b) **Determine your primary purpose.** What is the main point you wish to communicate? Build your presentation around that.

c) **Prepare an outline.** After deciding on the main points that you would like to communicate, start organising your ideas by making an outline. Use key words to convey the main ideas — never write out a script.

d) **Select effective supporting information.** Remember, your listeners will only remember at most three or four supporting points and only two or three supporting details for these points. So choose only the most important and most relevant information to include in your presentation.

e) **Choose a logical pattern of organisation.** Often your supporting information can be ordered according to one dominant pattern of organisation: problem-solution, criteria, process of elimination, experimental research, chronological description, or comparison and contrast, to mention a few. Whatever pattern you choose, try to stick to it!

f) **Prepare appropriate visual aids.** These are indispensable, firstly as prompts to help you and secondly as attention-getters. People remember visuals much more than they do words.

The following options are available for technical presentations:

- Chalkboard
- Flip charts
- Handouts
- Slides
- Three dimensional objects
- Overhead transparencies
- Computer screen projection (powerpoint)

Choose those best suited to your audience and to your purpose.

5.2 CONTENT: structure and signalling

Structure	Timing
1. Introduction State: what you will do (content) how you will do it (procedure)	10-20%
2. Main section list of points frame or focus each point	65-80%
3. Conclusion summarise	10-15%

[Source: Jordan, 1997 (p202)]

1. Introduction

Capture the interest of your audience from the beginning – make your opening comments strong. Never begin with an apology.

Remember it takes a few seconds for an audience to establish a relationship with a new speaker: don't begin with key information. You might say what your talk is about and show a transparency with the title on it – this allows the audience to settle in. After these preliminaries, you should introduce your topic. Depending on the length and type of your presentation, you should:

- explain the structure of your talk
- set out the aims and objectives of your work
- explain your approach to the topic

Make sure your listeners are clear about whatever the basic problem or issue is. If necessary, provide background information and define essential terms.

Practice this section, so that you can deliver the material in a flowing style, with less chance of mistakes.

2. Main Section

This section should include most of your experimental results or literature findings, depending on the type of presentation. However, keep details of methods to a minimum (just enough to explain your data). Remember, one of the most important skills for preparing successful presentations is ***ruthless cutting*** — for clarity, keep your presentation as simple as possible.

- Do not overwhelm your audience with large amounts of data. Present *summary statistics* rather than individual results. Show *final results* of any analyses in terms of the statistics calculated and their significance, avoid details of the procedures used. Results should be presented in an *easy format*.
- Graphs and diagrams are much more effective than tables: the audience will be able to see the trends and relationships in your data. Each diagram should have a short title and the symbols and trend lines should be clearly labelled.
- Take the audience through your story step-by-step at a reasonable pace. Try not to rush your story because you may be nervous. Avoid complex story lines and have your visuals well organised. If you need to use the same diagram more than once then you should make two copies.
- Consider the structure of your 'main message': keep it as simple as possible and announce each sub-division, so your audience is aware of the structure.

3. Conclusion

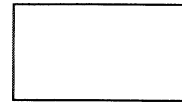
You must now bring your talk to a conclusion. Listeners' attention typically decreases during a presentation, but perks up again towards the end, when they hope to catch a closing comment or recommendation.

Finish as strongly and as clearly as you started. Provide your audience with a clear 'take-home message' by returning to the key points in your presentation. You might make a slide listing your main conclusions as a numbered series.

Signal the end of your talk by saying "Finally" or "In conclusion" and stop speaking after that sentence! Your audience will lose interest after that point. You may add a simple 'thank you' but don't say 'that's all folks!' or any other overly-informal remarks.

5.3 VISUAL MATERIAL

- Choose landscape orientation for your slides whenever possible.
- Never photocopy a page from a book onto a slide.
- Use only key words, do not write whole sentences. Slides should **complement** what you are saying, not duplicate it.
- Keep the amount of data to a minimum. Do not overcrowd your slides. Try to start each point at the beginning of a new line.
- Make sure the text is large enough to read: try out your material beforehand and choose a large font size. Avoid capital letters.



Arial bold 24 points is suitable

Graphs and Diagrams:

- Graphs: limit the number of trend lines and use different colours for each line.
- Separate the data into several simpler figures rather than one complex graph.
- Be creative: pictures, cartoons and photographs can make your presentation more interesting and more memorable.

Timing:

- You should speak for about 2 minutes for each slide. That means, for a presentation of 10 minutes, you should try to limit your slides to about 5.

Quality:

- Aim for uniformity — as much as possible, use the same format for each slide. Colour can enhance your slides but avoid using too much: for text, blue and black are easier to read than red or green.
- Transparencies can be typed and printed directly or photocopied. This usually gives a better result than handwriting.
- Spelling errors on slides look extremely bad. Always use the spell-check function or ask a friend to read them for you.

5.4 IMPROVING YOUR PERFORMANCE

Delivery¹⁴

The greatest obstacle to effective delivery is nervousness! The key is to convert your nervousness into the kind of energy that will inject liveliness into your speech. How can you do this?

- **Be well prepared.** Have all your notes and visual aids in order. Practice in the room and with the equipment you will actually use if possible.
- **Be well groomed.** Knowing you look good will boost your confidence.
- **Release tension.** Exercise, pray, listen to music, do whatever will help you to relax.
- **Establish contact with your audience beforehand.** This will help you concentrate on them rather than yourself.
- **Be aware of your posture and facial expressions.** Walk purposefully to the front, stand tall and smile when giving your presentation. Be sincere and talk 'to' your audience, not 'at' them.
- **Concentrate your full attention on what you have to say.** Stick to your outline and work on convincing your listeners. Keep up the pace, spending just long enough on each visual for the audience to absorb it. If you provide a steady stream of interesting information, your audience will pay attention and support you.

Practice

Practice, as the old saying goes, makes perfect. Practising your presentation in front of a friendly audience, or video- or tape-recording it, will all help you spot and correct any flaws: awkward transitions, poor delivery, length of presentation etc. In short, it will help you give your presentation effectively. Here are some things to watch out for:

- a) **Avoid monotony by devising interesting ways to reiterate your main points.** Your whole talk will be heading towards one "bottom line", so you will want to repeat certain points: try to vary your wording.
- b) **Avoid a breakdown in flow by creating smooth transitions between sections.** Practice using different phrases to 'bridge the gap' between sections in a natural way.
- c) **Avoid boredom by developing your own speaking style.** Practice telling stories to your friends as if you were giving a presentation. Stand tall, look them in the eye, use natural animated gestures, and

¹⁴ [Adapted from Huckin & Olsen, 1991]

vary your intonation and rate of speech. In short, let your enthusiasm show.

- d) **Rehearse your presentation.** Ask a friend to listen and to comment constructively on parts that were difficult to follow. Also check that your practice presentation fits well into the available time.
- e) **Use note cards with keywords and phrases.** As you rehearse, your confidence will improve and you will find a set of cards much easier to handle than pages of notes. If you must write a whole script to read from, then try to reduce it each time you practice, so that you end up with keywords and phrases only and your delivery is as natural as possible.

Questions

Sometimes you will be asked questions after a presentation. The best approach is to prepare beforehand:

- Consider what questions you may be asked and prepare brief answers. Have your friends throw every kind of difficult question they can think of at you: if you don't know the answers, go and do some research at the library. Some recommend that you should be prepared to give at least an educated guess, on the other hand ...
- If you don't know the answer, it may be better to admit this: your audience will appreciate honesty instead of a long distracting story which doesn't answer the question. Perhaps try to emphasise why you don't know the answer, eg: other results were much more interesting; that aspect was not included in your research (give reasons), etc
- Always be polite to questioners. Remember that you are in charge, if you only want to answer questions at the end, say so; or if the answer to the question would be disruptively long, ask the questioner to wait until the end. In any case, never argue with a questioner, it will only make your audience uncomfortable: suggest a discussion afterwards instead.

Learn from experience

Use your own experience of good and bad lecturers to shape your performance. Some of the more common errors include:

- reading from notes and ignoring the audience
- inexpressive, impersonal speech
- distracting mannerisms
- speaking too quickly
- poorly structured material with little emphasis on key information
- factual information too complex and detailed
- too few/many visual aids

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