Technical Report Writing and Research Methodology

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Objectives

At the end of this section you should be able to :

- *Understand the technical writing report*
- *Understand the purposes of a report*
- *develop research proposal*
- *design research experiment*
- *ability to demonstrate a professional level of communication (written, graphical/drawing and verbal) and presentation skills with clients*

CHAPTER ONE

Technical Report Writing

What is technical writing?

Technical writing is the process of writing and sharing information in a professional setting.

A technical writer’s main task is to convey information to another person or party in the most clear and effective ways.

The information that technical writers convey is often multipart, and to analyze the information and present it in a format that is easy to read and understand.

A good technical writer needs strong writing and communication skills.

Attributes of Technical Writing

In general, technical writing has a degree of formality, and it generally focuses on a specific subject with the purpose of making something happen or sharing useful information or knowledge.

General attributes of technical writing are listed as following.

- It pertains to a technical subject.
- It has a purpose.
- It has an objective.
- It conveys information/facts/data.
- It is impersonal.
- It is concise.
- It is directed.
- It is performed with a particular style and in a particular format.
- It is archival.
- It cites contributions of others.

Pertains to a Technical Subject

Technical writing must pertain to some aspect of engineering or the sciences in a given subject area such as the following:

- Philosophy, psychology, and religion
- History
- Geography and anthropology
- Social sciences
- Political science
- Law
- Education
- Fine arts
- Language and literature
- Science
- Agriculture
- Technology
- Health/medicine

Has a Purpose

A technical document always is written for a reason, and the purpose of reports may be to explain what was done, why it was done, and to illustrate the results of a study.

The purpose of reports on investigations is usually to present the results of the study.

The purpose of reports and papers should also be clearly stated, as in the following example:

It is the purpose of this report to present the results of a statistical study on the failure rate of spring latches on a type D cardiology cassette. There have been a number of latch failures uncovered in the inspection cycle, and this work is the first step in reducing the

Has an Objective

The objective of a technical report is the overall reason for doing the work. In an industrial situation, the objective of any work is usually to make or increase profits. In the preceding example, the objective was to reduce failure rates to a level of less than three STP. This will save money and increase profits.

Conveys Information/Facts/Data

Technical writing should have substance in every statement. If a sentence does not convey information pertinent to a study. Technical writing is focused on the technology under discussion.

A report without facts or scientific evidence to support an opinion also usually **lacks credibility**, and it is likely to be **unsuccessful in achieving** its purpose and objective. The following report selection illustrates reports with and without data.

No Data

A decision has been made to convert the machine shop grinding operations into a three-shift operation to increase efficiency and machine utilization.

Preferred—with Data

A study was conducted to improve the elapsed time required to grind a set of slitting knives. The average elapsed time for a regrind for the 1997 fiscal year was 11 days. A second study indicated that the largest time allotment in the 11 day regrind time was 3.4 days waiting for grinder availability. These studies were based on one shift (day). A three-week test with three-shift operation reduced the waiting for machine availability time to zero. The elapsed time for thirty knife sets that were ground in the three-week test time was less than one day. These test results suggest that three-shift operations should be implemented.

Most reports need facts or data to support conclusions and recommendations, and the verbs listed here are probably associated with factual statements:

- Determined
- Solved
- Built
- Accepted
- Rejected
- Completed
- Passed
- Failed
- Broke
- Approved
- Cancelled
- Invented
- Designed
- Developed
- Discovered
- Uncovered
- Deduced
- Studied

Verbs that are often not associated with factual statements include words
like the following:

- Think
- May be
- Suggest
- Appear
- Suppose

Impersonal (Third Person) Voice

The use of first person pronouns is usually discouraged in technical writing. The intrusion of “I” makes the work less authoritative. Similarly, it is in appropriate to use names of people and/or trade names unless there is no other way to describe the item.

Discouraged

I ran a series of hardness tests on the valve seals for Bob MacArther from the shops division, and I found that three of the seals were below normal. I also notified Harry Randall and Phylis Carter so that the two of them could do Rockwell measurements on future value seals.

Preferred

A series of hardness tests were conducted on valve seals at the request of the Shops Division, and it was determined that three parts had abnormally low harnesses. The appropriate individuals were notified so that they can request hardness testing on future valve-seal shipments.

Be Concise

Technical reports are usually written for business reasons. They are not intended to entertain; they communicate information to an identified person or group. Say what you want to say and get out! Wandering sentences and extra words reflect badly on the author and often have a negative effect on the readership that you are trying to reach.

Directed to Readers

technical reports must be directed to a particular readership. The author is responsible for determining the specific individuals or parties who will receive a technical document. Writing should be aimed at the readership.

Directing a report also to determines the technical level of writing. If you direct a report to your coworkers, you do not have to bring them up to speed on the organization of your department. They already know it.

Style and Format

The attributes of technical writing also include style and format.
Style is the way that you write;
format is the ordering and physical layout of a document.
The format (basic elements and their placement) of technical papers
and reports is a more structured one than that used for other forms of writing.

Formal technical reports have basic elements and a structure as follows:

- Introduction (why you are doing the work)
- Procedure (what you did)
- Results (what happened)
- Discussion (what it means)
- Conclusions (what was learned)
- Recommendations (what is to be done with the new information or knowledge)

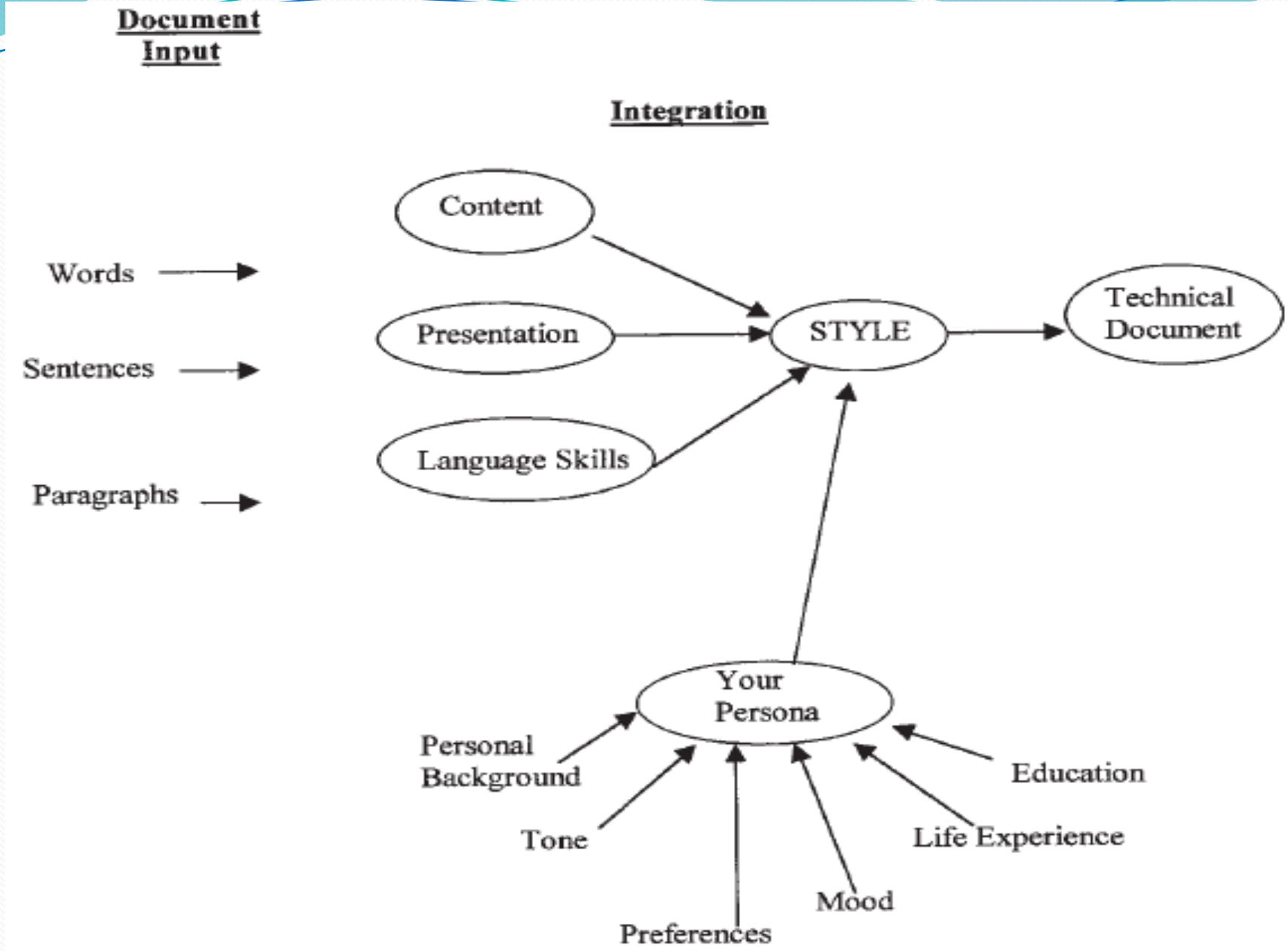
2. Writing Style

Goals

- *Understand the elements of style in technical writing*
- *Become familiar with the style that is most suitable for technical reports*

Writing Style refers to mannerisms in word usage.

- It is the way that the writer consistently and unconsciously **chooses words, forms sentences and paragraphs, and combines them with ideas and thoughts to create a document.**
- A document is a composition that integrates the elements of style into a finished work.
- Technical writing is a finished work done for a reason. There is a purpose and objective for every document.
- Writing style will help determine success in achieving the goals of a document.

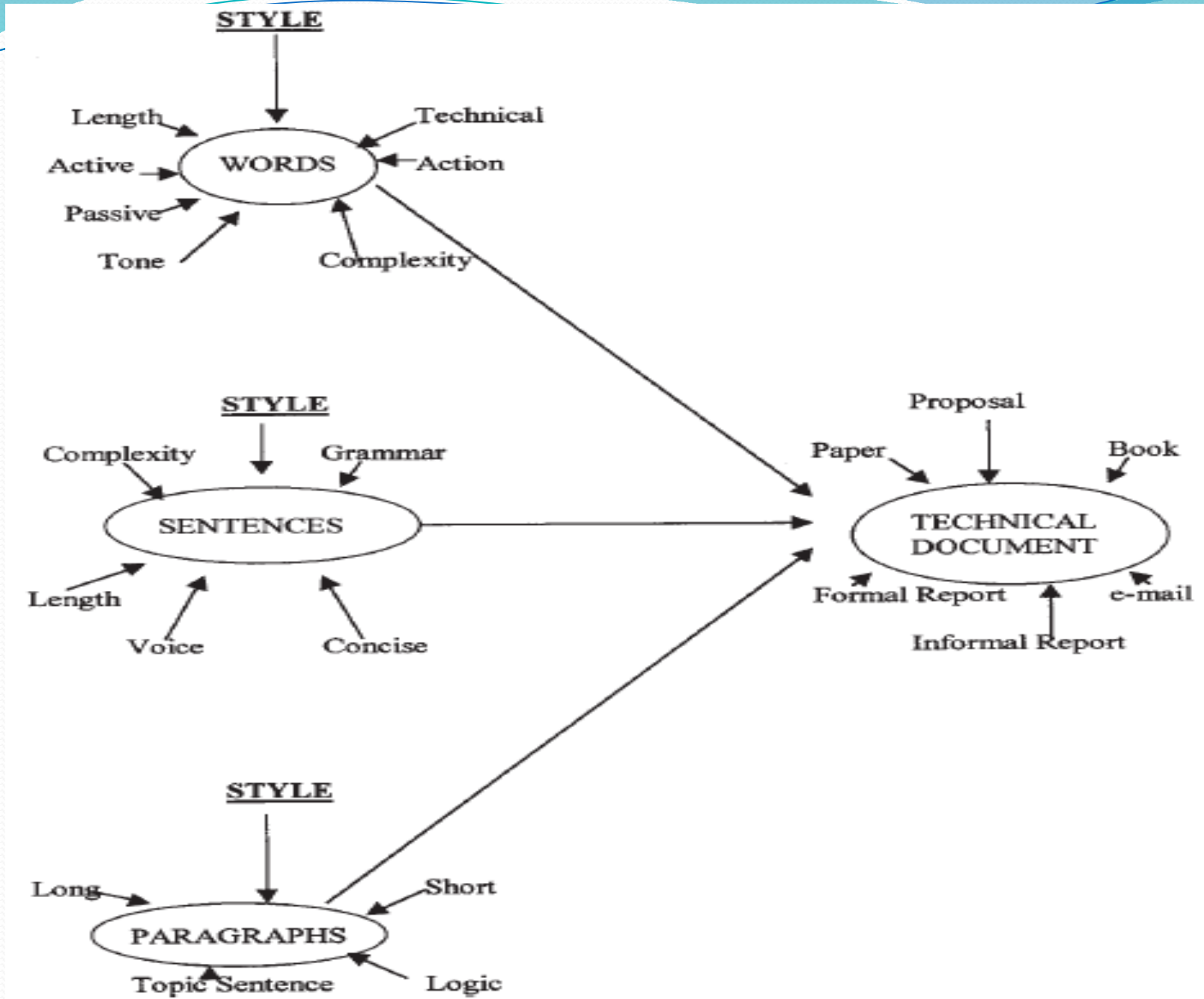

Document Input
Integration
Words
Sentences
Paragraphs
Content
Presentation
Language Skills
STYLE
Technical Document
Your Persona
Personal Background
Tone
Preferences
Mood
Life Experience
Education

Elements of Style

Criteria for Good Technical Writing are document content, presentation, and language skills, but style starts your previous.

It starts with writer choices of;

- word usage,
- how words are put into sentences,
- how paragraphs are constructed, and
- how they are presented to readership in the final work.


STYLE
Length
Technical
Active
WORDS
Action
Passive
Tone
Complexity
STYLE
Complexity
Grammar
SENTENCES
Length
Voice
Concise
STYLE
Long
Short
PARAGRAPHS
Topic Sentence
Logic
Proposal
Paper
Book
TECHNICAL DOCUMENT
Formal Report
e-mail
Informal Report

Personal affects word choice and results in a particular style.

If you are a gregarious person, you may be prone to use words like “bold, hearty, and beautiful.”

An introverted person is likely to use words that do not draw attention to himself or herself.

Words like “anticipate, therefore, follows” may be selected as a reflection of an introverted personality.

writing style has a tone, which is a reflection of writer **attitude or feelings.**

If you are angry at your manager at the time of writing, this may show in your writing as snipping remarks or angry words.

Angry Tone

The project would have been completed as scheduled if we had management cooperation.

Angry Words

- Noncommittal
- Procrastination
- Disappointing
- Uncooperative
- Unqualified
- Sloppy
- Nonconforming
- Shoddy

Technical writing, by definition, should be objective and impersonal.

The tone should be neutral.

In other words, the tone should be dispassionate, impartial, and unbiased.

Tone may be influenced by;

your feelings at the time of writing,

how you feel about yourself,

how you feel about your boss,

company mate, or health.

RULE DO NOT LET PERSONAL FEELINGS SHOW IN WRITING.

Word Choice

There are many types of words, and choice of words is a major part of writing style.

Many words have a “personality” of their own, just as words may reflect the personality of the author.

Clichés are essentially figures of speech. Groups of words are taken together to have a contemporary meaning.

Foreign words are also part of the English language, such as, restaurant (French), pizza (Italian), envoy (French), soprano (Italian), and resume (French).

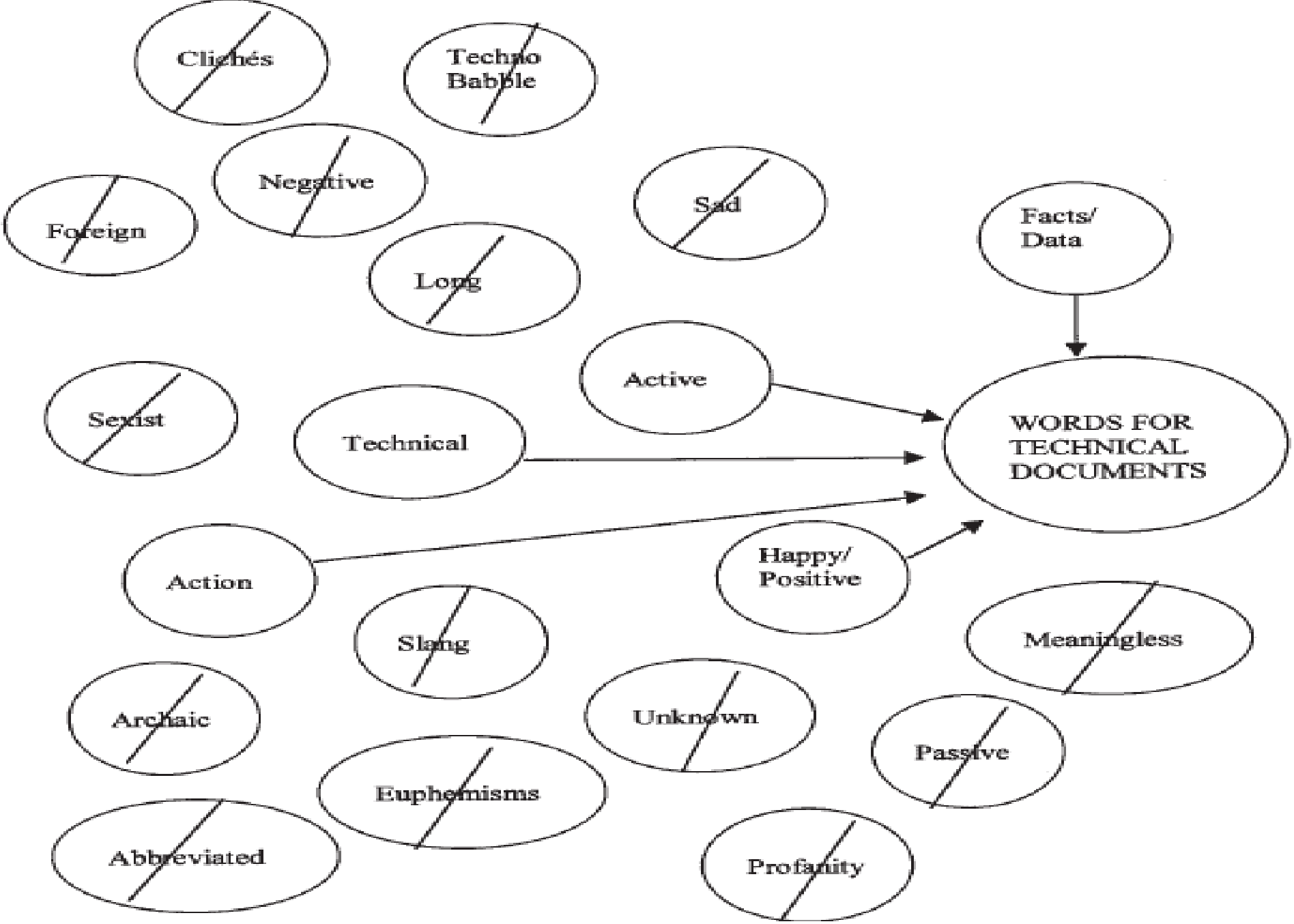
the author, must decide if your readership will know their meanings: etc. = et cetera = and so forth

Ibid = ibidem = in the same place (cited previously)

et al. = and others

per se = by itself

i.e. = id est = that is



Word choices for technical writing

Words with a presumption of gender: chairman, congressman, salesman, meter maid, repairman, and so forth.

These words suggest that only a man or a woman could do them, which is often an anachronism.

Nowadays, professional writers avoid words with any arbitrary or presumptuous reference to a specific gender, religion, ethnic group, or special group.

Current salutations include “Dear Resident,” “Dear Subscriber,” and “Dear Reader.”

Salesperson is used in place of salesman. Chair is

Action words are meant to evoke or elicit feelings of excitement or progress.

The people who promote these exercises insist on using words of action in developing these statements.

Some words by nature have that connotation. Race, fight, beat, and convert all imply action.

When you use these words, you describe something that happened, or you try to evoke action or excitement from the reader.

Conversely, verbs that do not suggest as much action are list, number, think, consider, study, and so forth. These words are simply not as bold.

Archaic or old fashioned words can be used, but possibly only old readers will know what they mean.

ontemporary abbreviations of words

Negative words undesirable, whether used as nouns, verbs, or modifiers.

Many English words almost always evoke negative reacti

- Lazy
- Loud
- Indolent
- Fat
- Shiftless
- Boisterous
- Ignorant
- Impolite
- Rude
- Terse
- Crazy
- Dumb

Their use is usually avoided in technical writing

Technical words are certainly to be expected in technical documents, but there can be an overdose.

Too Many Technical Words

The analysis of the spectral frequency output of the Johannsen-type goniophotometer was accomplished by embedding algorithms in a derived linear regression analysis computer program. Second order derivatives . . .

A technical document may miss its mark if the reader is not familiar with many of the words.

Slang Words like “hosed,” “neat,” “cool,” and “bummer” have well-known meanings in the United States:

1. Hosed means cheated.
2. Neat means nice.
3. Fine means attractive.
4. Bummer means negative outcome.

They are used in most circles, but none of them read well in technical writing.

Euphemisms are words or phrases used in place of what really needs to be said.

In many cases, euphemisms are used to make things sound better.

For example, garbage collectors are called sanitation workers; it is more genteel to say “where is the restroom?” than “where is the toilet?”

Industrial euphemisms	Meaning
Strategic frame	work Plan
Downsizing	Layoff
Technology road maps	Plan
Operational excellence	Good work
Career enhancement	more work
Development opportunity	Problem
Diagonal slice	Opinions
Performance matrix	To-do list
Shareholder satisfaction	Quarterly results
Overarching goals	Objective

The user usually intends to make something sound nicer, but in reality the readers often miss the intended meaning or may be irritated with the unnecessary

Long words and complex words Good documents of any type are concise, and the following words and phrases are examples of wordy phrases and more concise alternatives:

Wordy phrase	concise replacement
And so as a result	Hence
Day to day routine	Routine
On the rise	Growing
On the basis of	Based on
Not withholding the fact that	But
Is knowledgeable about	Knows
It is evident that	Clearly
It is important to note	Note

Concision can also be applied to individual words.

Big word	Concise replacement
Facilitate	Help
Contact	Call
Attempt	Try
Additionally	Also
Congregate	Gather
Significantly	Greatly
Springtime	Spring
Therefore	So
Utilization	Use

Uncommon words (such as inclination, unctuous, abrogate, and ameliorate) are not widely known and make reading more difficult.

Technobabble includes manufactured words and phrases similar to some industrial euphemisms.

Every profession has words with special meanings, but overuse of specialized terms or big words (strategize, overarching, deliverable, and so forth) with simple meanings may only just difficult to understand the meaning and frustrate the readers.

These words have meaning within the profession, but the meaning outside may be very different.

Profanity is, of course, totally unacceptable in any business or technical document.

Profane language often has sexual overtones that would violate most sexual harassment guidelines.

Active and passive words involve the reader in very different ways.

Writing in the active voice usually makes documents more readable.

The **active voice** is a good attribute in any form of writing, because writing in the active voice makes your statements more forceful.

The active voice simply means that the subject of the sentence does action. **Passive voice,** on the other hand, does not identify who is doing the action:

Words that evoke happiness or sadness Feelings of happiness or sadness are not objectives in report writing, but there may be occasions to use these kinds of words in business or day-to-day communications.

Meaningless or misleading words Many well-used words in the English language do not provide any meaningful information. For example, most superlatives (best, greatest, superior, fastest, and so forth) are meaningless or misleading words without factual foundation.

Never claim product superiority without test data to

Some other examples of meaningless or very misleading words include:

- outstanding
- biggest
- ultimate
- optimize
- maximize
- cheapest
- farthest
- robust
- highest
- friendliest
- fastest
- lowest

Sentence Construction

Construction of good sentences follows directly from word choice.

Build sentences with concise, vigorous/energetic, and substantive(true idea) words in the active voice.

Include valid facts and data.

Suppress your inclination to use meaningless and negative words, euphemisms, and abbreviations.

Problem One: Starting with Dependent Clause. It is not grammatically wrong to start a sentence with a dependent clause, but the resulting sentences often lack concision and are difficult to understand. Eg.

Starting with a Dependent Clause

At the start of the business year and at the beginning of the third quarter, the laboratory has a project review with the director of research.

Starting with a Noun

The laboratory has a project review with the director of research each January and July. The sentences in the preceding two examples have the same meaning, but the latter is more clear and concise.

The modifying phrase with the date is still present, but it is

Beginning with a Clause

Traveling to the western tank farm, he met three lab members near building 318.

Were the lab members traveling to the tank farm or was he? This is the kind of confusion that often occurs when a dependent clause is moved away from the word that it modifies.

Beginning with a Pronoun

He met three lab members on his way to the western tank farm. They were near building 318.

This second version is clearer. Many times clarity can easily be improved by breaking a long sentence into two or more sentences.

Problem Two: Subject and Verb Do Not Agree. As we all know, the rules of English require agreement of subject and verb.

If the subject is singular, the verb must also be singular.

Long sentences with many clauses often create a significant physical separation of the subject and verb, and this often leads to subject-verb disagreement.

Subject and Verb Do Not Agree

Metallography of failed balls and races are key aspects of failure analysis. The subject, metallography, is singular, but the sentence uses a plural verb, because the author has confused the modifying words “of balls and races” as the subject.

Problem Three: Incoherent Sentences. Incoherent sentences usually result from the omission of a word. *(a mistake resulting from neglect)*

Incoherent

The procedure for cutting circuit boards for failure study begins stripping the devices.

In this example, the writer left out “with” between begins and stripping.

Incoherent

Differential scanning calorimetry (DSC) and thermo gravimetric analysis (TGA) to determine if any significant differences existed between the samples identified as A and D.

It appears that a “were used” or “were employed” was

Problem Four: Same-Sounding Word and Wrong Usage. A significant number of English words have the same pronunciation but very different meanings, such as:

- Two, to, and too
- Coarse and course
- Principal and principle
- Loose and lose
- Plane and plain
- Their and there
- See and sea
- Affect and effect
- Brake and break

The problem width a spell checker

Eye wood like to show that spell check hers will knot all ways fined words that are used inn correctly. The rite spelling is only pro deuced by reeding the work over and by watching for words with multi pull spellings. All duel spellings caught bye soft wear cannot be assummed.

The solution to this problem is to reread your work after using the spelling checker.

Problem Five: Sentences Containing Slang or Idioms.

Slang is never proper in writing.

The readers may assume that the writer does not know the proper terms and question author credibility.

Slang and idioms are particularly inappropriate in communications.

Readers who have English as a second language may not be familiar with slang or idiomatic expressions and may completely misread your document.

Use of an Idiomatic Expression

The rejection rate is higher than normal for the delta station chassis that we have received from France. Please get on top of the situation.

Use of Slang

The transport roller bearings were hammered. There was reddish goop coming out of the seal. We decided that this baby had to go, and we served up a new issue.

Translation

The transport bearing failed. Wear debris was apparent in the seal area, and a decision was made to replace it.

Summary

Sentences need to be clear, concise, understandable, and based on positive words. A writing style should use sentences free of clauses that can confuse, slang, idioms, and errors in grammar or punctuation.

These mistakes can easily be prevented by

Paragraphs

Paragraphs make reading easier by breaking a document into pieces.

It would be difficult to read any document without paragraphs, as the human eye and brain need to recognize when an author finishes one thought and moves to another.

Rule of paragraph

- Every paragraph must have a topic sentence.
- Paragraphs contain a complete thought.
- Paragraph length needs to be just right; just give enough information for a thorough discussion of the topic sentence.

The End