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Chapter One. Academic Style

The style of academic English differs from that of the everyday spoken form in four fundamental ways. It tends

• to follow conventions for reporting research according to particular schemata, which are explicit in their organisation. There are often discipline-specific variations in these conventions.

• to use strategies for signalling the writer's distance and attitude to claims and arguments.

• to consist of sentences which are longer and more complex than in everyday texts.

• to require more formal vocabulary and grammatical structures.

Vocabulary choice

A writer's choice of individual words plays a significant role in the creation of a text, which both sounds academic and communicates the writer's message clearly to the readers. Three of the most important factors are described below.

Formality

The most notable feature of academic writing style is the preference for a more formal alternative when choosing a **verb**, **noun**, or other parts of speech.

Certainty and strength

Another feature of an academic writing style is the need for writers to express their commitment to their own claims and those of others. This can be generally seen in the choice of vocabulary that signals the degree of confidence (certainty) that writers have towards claim with his research.

Other preliminary results **demonstrate** (certain) / **suggest** (less certain) that blue light (460 nm) is more efficient than white light in resetting the human circadian pacemaker. Recent tests

have **generally** (weak) / **clearly** (strong) shown DVD-R to be slightly more compatible than DVD+R.

Attitude

Novice writers often overlook the importance of providing adequate evaluative commentary. Far too often they believe that by simply listing data, the facts will speak for themselves.

Wrong: Option X requires installation of a LAN, **and** Option Y requires the installation of new software on each individual work station.

Right: Option X **only** requires installation of a LAN, **while** Option Y **relies on** the installation of new software on each individual work station.

It is possible to show your attitude using a range of verbs, adjectives and adverbs, as you will see in the following pages. The examples and exercises in this section aim to help you distinguish between vocabulary choices in terms of **formality**, **certainty**, and the **attitude** signaled by your words. As can be seen from the list below, these common Anglo-Saxon verbs can have many meanings.

Informal	**Formal (Written)**
Be	be situated, be located, be placed, be positioned; be outlined, be listed, be described; serve as
Do	perform, implement, execute, complete, conduct, function, operate
Get	become, acquire, procure, receive, gain, obtain, achieve, attain
Give	provide, offer, supply, transfer, yield; allow, permit, enable; contribute
Go	proceed, pass, process, transfer, transmit
Happen	Occur
Have	possess, include, incorporate, contain, involve, consist of, be composed of, comprise

Make	produce, generate, create, assemble, build, construct, erect, fabricate, fashion, forge, form, frame, manufacture, mold
Mean	denote, indicate, imply, suggest, signify
Put	place, attach, insert, apply, connect, join, link, unite; adhere, anchor, secure, implant, imbed

Avoid phrasal verbs

For written academic style, a single-word Latinate verb is preferred whenever possible. This is one of the most dramatic shifts from informal to formal style.

Phrasal verb: ☹	The aim of this study is to **look at** the growth dynamics and to **find out** the microbial populations living in the C140 prototype hydraulic system.

Latinate: ☺	The aim of this study is to **examine** the growth dynamics and to **determine** the microbial populations living in the C140 prototype hydraulic system

Table 2: Vocabulary shift: avoid phrasal verbs

Informal	**Formal (Written)**
bring up	raise, present
build up	accumulate
come up with	devise, invent, develop; produce, supply
do away with	eliminate, obviate
find out	determine, develop; detect, observe
get rid of	eliminate
go down/up	decrease, decline, diminish/increase, rise, augment
take care of	manage, operate

Nouns

Many nouns used in everyday spoken English tend to be less appropriate for academic writing. Some of these are listed below.

Table 3: Vocabulary shift: nouns

Informal	**Formal (Written)**
know-how	expertise
a trade-off	a compromise
trouble	difficulty
away (to do sth)	an approach, a means, a method, a technique, a procedure
an idea	a concept, a plan, a notion, a view
the meaning (of. . .)	the purpose, aim, objective, goal, target
an answer	a solution
a thing	a device, an object, an item, an entity, a structure, a tool, an instrument
stuff	material, a substance, a liquid, a gas

Adverbs

Many of the most common, everyday English adverbs have a more formal equivalent. Some of these are listed below.

Adverbial connectors

Although you may frequently see in magazines and newspapers sentences beginning with *but*, *and*, *also,* and *so*, this is not considered appropriate style in academic writing. Avoid beginning sentences with these conjunctions in academic writing. Instead, choose from a variety of contrastive, *additive,* and *causative sentence connectors.*

Informal	**Formal (Written)**
often	Frequently
Sometimes	Occasionally
Always	Typically
Nowadays	currently, presently
a little bit	somewhat
a lot	much, greatly, dramatically, drastically, considerably
more and more	increasingly
Fast	Rapidly

Informal: ☹ There is enough coal in the US to power America's electrical plants for another 250 years. **But** burning coal releases greenhouse gases that cause global warming.

Formal: ☺ There is enough coal in the US to power America's electrical plants for another 250 years. **However**, burning coal releases greenhouse gases that cause global warming.

Similarly, the adverb **besides** is replaced by its more formal equivalent **in addition to**, and **too** by **also** or **as well**.

Adjectives

Many of the most common English adjectives sound childish when used in a formal text.

Informal: ☹	Such precision signals a **big** advance in mechanical engineering.
Formal: ☺	Such precision signals a **major** advance in mechanical engineering.

Table 4: Vocabulary shift: adjectives

Informal	**Formal (Written)**
a lot of, lots of	many, numerous, a large number of
Big	large, great, high, major
small, tiny	minute, insignificant
Hard	difficult, arduous, laborious
Good	suitable, appropriate, effective, efficient, beneficial, advantageous
Bad	poor, inappropriate, unsuitable, ineffective, inefficient, unsatisfactory, defective

Slang: ☹	Impact occurred at a **huge** velocity.
Formal: ☺	Impact occurred at a **high** velocity.

Prepositions

English avoids consecutive repetition of the same preposition. Luckily, more than one preposition can typically provide the same meaning.

☹ As a result **of** a previous phase **of** the analysis **of** the different solutions, numerous changes had to be made to the prototype before it could be tested.

☺ **Due to** a previous phase **in** the analysis **of** the different solutions, numerous changes had to be made to the prototype before it could be tested.

Table 5: Vocabulary shift: prepositions

Informal	**Formal (Written)**
about (sth)	concerning, on, regarding
After	subsequent to
Before	prior to
In	Within
on top of	above, after
during (the last 5 years)	Over

While they are perfectly suitable for spoken English, contracted forms are not suitable for academic or scientific English:

Contraction	**Full form**
Doesn’t	does not
They‘re	they are
We‘ll	we shall/will
it‘s	it is

Don’t overuse weak verbs, such as *to be*, *there is/are*, or *to have* because this way you will hide actions in noun phrases.

To BE

☹ The **analysed** characteristics **were** the dry weight (DW), the loss on ignition (IL), as well as concentrations of total phosphorus (Ptot), total nitrogen (Ntot), and total carbon (Ctot).

☺ The following characteristics **were analysed**: the dry weight (DW), the loss on ignition (IL), as well as concentrations of total phosphorus (Ptot), total nitrogen (Ntot) and total carbon (Ctot).

THERE IS/ARE

☹ **There is** no harm using cellular phones inside the hospital.

☺ Using cellular phones **cause**s no harm inside the hospital.

TO HAVE

☹ This **has** the **tendency** to make log browsing a tedious and ineffective process.

☺ This **tends** to make log browsing a tedious and ineffective process.

Put topical info in subject position

Often novice writers mistakenly believe that to sound academic they need to write using the passive verb form.

Overuse of IN + passive

☹ Topic hidden in a prepositional phrase:

In LOGISTICS, simple transaction data and averaging **are** often **used** to allocate direct costs.

☺ Topic in subject position:

LOGISTICS often **uses** simple transaction data and averaging to allocate direct costs.

☹ Top heavy, verb at the end:

In addition to each separate variable, a forecasting model was built, **where** *the interactions between the variables* **were considered**.

☺ New information at the end after the verb:

In addition to each separate variable, a forecasting model was built, **WHICH considers** into account *the interactions between the variables*.

Overuse of BY + passive

When the intoductory element is **by** or **with** expressing the **means** for accomplishing an action, you can use the verbs **enable**, **allow,** or **permit** as the main verb to move new information to a position after the verb.

☹ Topic hidden in prepositional phrase:

By COLLECTING more data, a much deeper understanding of the cost behaviour of an

activity and products **can be achieved**.

☺ **Topic in subject position:**

COLLECTING more data **enables/ allows/ permits** a much deeper understanding of the cost behaviour of an activity and products **to be achieved**.

☹ In the literature*;* **can be found** several studies that have developed media delivery platforms and video streaming for the Internet.

☺ **The literature contains** several studies that have developed media delivery platforms and video streaming for the Internet.

☹ In figure 2 **is presented** the factors associated with work motivation.

☺ **Figure 2 presents** the factors associated with work motivation.

Put action into verb

Overuse of do, make, perform, achieve, accomplish

The most common way to hide action is to use the nominalized form of a verb with the verbs **do, make, perform, achieve, accomplish, carry out,** or **conduct**.

☹ **Action hidden in noun:**

Verification of THESE PROPERTIES can be **DONE** using linear algebraic techniques.

☺ **Action put into verb:**

THESE PROPERTIES can be **VERIFIED** using linear algebraic techniques.

☹ **Action hidden in noun:**

There has been **continuous improvement** in economic performance since 2002.

☺ **Action put into verb:**

Economic performance **has continuously IMPROVED** since 2002.

☹ **Action hidden in relative clause:**

There are **several factors that can INCREASE** the complexity and number of components within a product.

☺ **Action put into verb:**

Several factors can INCREASE the complexity and number of components within a product.

Avoid run-on expressions

When listing examples, avoid ending your list with such expressions as **etc, and so forth,** or **and so on.** Instead, academic English prefers to use a a **superordinate term** followed by **including, such as,** or the verb **to include.**

☹ Scientists theorize that global temperature change may be induced by *volcanism, solar activity, etc*.

☺ Scientists theorize that global temperature change may be induced by **natural causes**, **SUCH AS** *volcanism* and *solar activity*. .

Punctuate *e.g.* correctly

Note that the abbreviation *e.g.* is mainly used to present examples given in parentheses, and should not be used as a substitute for *for example* or *for instance* in normal academic texts. Use two periods (**.**) to punctuate *e.g.* in American English, whereas they may be unpunctuated (*eg*) in British English. Surround this abbreviation with commas to separate it from the rest of the text.

☹ Scientists theorize that global temperature change may be induced, *e.g.,* by *volcanism* or *solar activity*.

☺ Scientists theorize that global temperature change may be induced by **natural causes (e.g.,**

volcanism and *solar activity***)**.

Formal structures for listing

- Scientists theorize that global temperature change may be induced by natural causes, **SUCH AS** *volcanism and solar activity.*
- Scientists theorize that the factors leading to global temperature may **INCLUDE volcanism and solar activity**.
- Scientists theorize that global temperature change may be induced by a variety of **natural causes, INCLUDING volcanism and solar activity**.

Table: Typical quantifiers

A variety of	A number of	Many	An array of
Various	Numerous	Much	Several

Scientists theorize that global temperature change may be induced by **two natural causes: volcanism, solar activity, AND OTHER** natural causes.

BEWARE! Avoid using **like** to introduce examples. Like has the meaning of **similar to**, not *for example*!

☹ Scientists theorize that global temperature change may be induced by natural causes, like **volcanism and solar activity**.

☺ Scientists theorize that global temperature change may be induced by natural causes, **SUCH AS volcanism and solar activity**.

Use **Like** to make comparisons or to show similarities between two concepts:

☺ **LIKE volcanism, solar activity** is also believed to induce global temperature changes.

Don’t confuse *i.e.* with *e.g*

Many novice writers tend to overuse, abuse, and confuse the abbreviations **e.g.** and **i.e.**. While the abbreviation **e.g.** (Latin: *exempli gratia*) means *for example,* i.e. (Latin: *id est*) means that is to say and offers an **explanation**, not an example.

CORRECT: TWO COMMAS

Punctuation is the act and result of punctuating**, i.e.,** *using punctuation marks*.

Punctuation is the act and result of punctuating (**i.e.,** *using punctuation marks*).

Punctuation is the act and result of using punctuation marks (**e.g.,** *commas, semicolons, and apostrophes*).

Introducing a noun phrase or list of nouns

Use a semicolon before introductory words such as *namely, that is, for example,* or *for instance* when they introduce a **complete sentence**.

Incorrect: Use full form in running text

The names of institutions are proper nouns and should therefore be capitalized**, i.e.,** *the initial letter of all nouns in the name should be written in upper case script*.

The names of institutions are proper nouns and should therefore be capitalized**, e.g.,** *the Iran University of Science and Technology* requires capitalization of all the words in the name except for the preposition *of*.

Correct: With semicolon and final comma

The names of institutions are proper nouns and should therefore be capitalized**; THAT IS,** *the initial letter of all nouns in the name should be written in upper case script*.

The names of institutions are proper nouns and should therefore be capitalized**; FOR**

EXAMPLE, *Iran University of Science and Technology* requires capitalization of all the words in the name except for the preposition *of*.

Avoid question forms

One common feature of academic English is that it avoids **direct questions**, allows **indirect questions** introduced by **how, why, what, which, whether**, but prefers to convert questions into noun phrases introduced by nouns such as *way, method, means, reason, type,* and *quantity*. The examples below outline some of the strategies you can use to avoid question forms. Note how the order of the **SUBJECT** and the **verb** are not inverted in the indirect question forms below.

What questions

☹ **Direct question form:**

This study aims to determine **WHAT are** the specific engineering properties that are required to maximize the service life of the product?

☺ **Indirect question form:**

This study aims to determine **WHAT** the specific engineering properties **are** that are required to maximize the service life of the product.

☺ **Noun phrase:**

This study aims to determine ~~what are~~ **THE SPECIFIC ENGINEERING PROPERTIES** ~~that are~~ required to maximize the service life of the product.

How questions

☹ **Direct question form:**

This report aims to determine **HOW can** the department **lower** costs?

☺ **Indirect question form:**

This report aims to determine **HOW** the department **can lower** costs.

☺ **Noun phrase:**

This report aims to determine **WAYS for** the department **to** lower costs.

This report aims to determine **WAYS to** lower costs in the department.

This report aims to determine **WAYS of** lower**ing** costs in the department.

This report aims to determine **METHODS for** lower**ing** costs in the department.

This report aims to determine **MEANS for** lower**ing** costs in the department.

Why questions

☹ **Direct question form:**

This report explains **WHY was** the MSM **built** on the Java 2 platform.

☺ **Indirect question form:**

This report explains **WHY** the MSM **was built** on the Java 2 platform.

☺ **Noun phrase:**

This report explains **THE REASONS for** build**ing** the MSM on the Java 2 platform.

Which questions

☹ **Direct question form:**

WHICH motherboard **is installed** on your computer?

☺ **Indirect question form:**

The BIOS version string can be used to determine **WHICH** motherboard **is installed** on your computer.

☺ **Noun phrase:**

The BIOS version string can be used to determine **THE TYPE OF** motherboard is **installed** on your computer.

Open questions

Unlike the other types of question forms listed above, most open-ended questions can best be expressed as **indirect questions** introduced with **whether**.

☹ **Direct Question form:**

The purpose of the study was to determine **CAN** painted surfaces **BE MADE** slip-resistant?

☺ **Indirect Question form:**

The purpose of the study was to determine **WHETHER** painted surfaces **can be made** slip-resistant.

☺ **Noun Phrase:**

The purpose of the study was to determine **THE FEASIBILITY OF** mak**ing** painted surfaces slip-resistant.

BEWARE! You cannot use **if** in indirect questions. Instead, use **whether** in indirect forms.

☹ This study aims to determine **if** painted surfaces **can be made** slip-resistant.

☺ This study aims to determine **WHETHER** painted surfaces **can be made** slip-resistant.

Expressing means

The methods section primarily consists of three basic information elements: **action, means,** and **purpose**.

Quantitative determinations

[VARIABLE] The electrical properties of the capacitors	**[ACTION]** **were measured**	**[MEANS]** **using** a Hewlett-Packard impedance analyzer.
[MEANS] A Hewlett-Packard impedance analyzer	**[ACTION]** **was used**	**[PURPOSE]** **to measure** the electrical properties of the capacitors.

[PURPOSE] **To measure** the electrical properties of the capacitors	**[ACTION]** **we used**	**[MEANS]** a Hewlett-Packard impedance analyzer.
[GOAL] Measurements	**[ACTION]** **were performed**	**[MEANS]** **on** a Hewlett-Packard impedance analyzer.

Form of citation

Integral citation

1. **Smith (2005)** suggested that coyotes may have reduced the carrying capacity of bobcats in eastern Maine by diminishing the availability of prey.

2. In a study of habitat partitioning in eastern Maine, coyotes were found by **Smith (2005)** to have reduced the carrying capacity of bobcats by diminishing the availability of prey.

Non-integral citation

1. Coyotes may affect the carrying capacity of bobcats by diminishing the availability of prey **(Smith, 2005)**.

2. Recently, it has been suggested that coyotes may affect the carrying capacity of bobcats by diminishing the availability of prey **(Smith, 2005)**.

3. In a study of habitat partitioning in eastern Maine, coyotes were found to have reduced the carrying capacity of bobcats by diminishing the availability of prey **(Smith, 2005)**.

Sentence-initial position

1. **Smith (2005)** reported that.. . .

2. In a study of partridge by **Smith (2005)**, it was found that.. . .

3. As was also shown by **Smith (2005)**, our results indicated that. . .

4. According to **Smith (2005)**,. . .

Sentence-final position

1. . . . has been reported by **Virtanen (2005)**.

2. . . . , as previously reported by **Virtanen (2005)**.

Commonly Misused Words

Accept/Except

“Accept” means to take or receive something.

- **He *accepted* his diploma with a smile.**

“Except” means to exclude or leave out. Also used the same as the word “but.”

- **We have all of the chemicals *except* the chorine.**

Affect/Effect

"Affect" when used as a verb, means to have an influence on something.

- **The temperature of the room *affects* the quality of the ice cream.**
- **The faculty was able to positively *affect* the students' technical writing ability.**

"Effect" is most often used as a noun and means the result or consequence.

- **The high quality presentations had a positive effect on the students' confidence.**

"Effect" when used as a verb, means to create or bring about.

- **We are confident that an improved program will effect a positive change in attendance.**

"Effective" is an adjective, which means having the right effect.

- **The professional agenda proved to be effective in increasing club membership.**

Generally speaking, **affect** is the **act**, and **effect** is the **result**.

Among/Between

“Among” refers to being surrounded by (usually more than two things).

- **She was *among* relatives.**

"Between" refers to the space separating things or places.

- **The cost was split *between* the three of them.**

Amount of/Number of

"Amount of" refers to things that are measured.

- **We could not measure the *amount of* heat coming out of the oven.**

"Number of" refers to things that can be counted.

- **The *number of* books that were missing was recorded.**

As/per

This is not a good form. Write "per your request" or "as you requested."

Assure/Ensure/Insure

"Assure" means to declare earnestly or confidently; give someone confidence.

- **She *assured* us that the money will be secure.**

"Ensure" means to make sure or certain.

- **We will *ensure* that the reports will be delivered on time.**

"Insure" means to guarantee or secure indemnity against loss or harm.

- **They *insure* employees for loss of a limb of life while on the job.**

Comprise/Compose

"Comprise" means to include, contain, or consist of.

- **The class is comprised of Biosystems Engineering students.**

"Compose" means to be made of parts.

- **Ice cream is composed of many ingredients.**

Datum/Data

A "datum" is singular; "data" is the plural form of "datum."

- **The datum appeared to be in error.**
- **The data were collected in the laboratory.**

Due to/Because/Since

"Due to" means "caused by."

- **She lost her job due to her lack of effort.**

"Because" shows reason by cause or effect

- **He missed his appointment because he overslept.**

"Since" is relative to time, before the present time, or after a time in the past.

- **The department has hired three new faculty *since* last semester.**

e.g./et al./i.e.

"e.g." is the abbreviation for the Latin term "*exempli gratia*" and means "*for example*." A period follows each letter, then a comma, which is followed by the example given.

- **They were selling summer vegetables (e.g., carrots, corn, tomatoes) along the roadside.**

"et al." is the abbreviation for the Latin term "*et alii*" and means "and others."

- **Jones *et al.* were responsible for the entertainment.**

"i.e." is the abbreviation for the Latin term "*id est*" and means "*that is*," "therefore," or "*in other words*."

- **Previously derived and readily available analytical results can be quoted with suitable reference; i.e., equations from a text.**

Its/It's

"Its" is possessive without using an apostrophe, like theirs, ours, yours, his and hers.

- **The deer stopped in *its* tracks.**

"It's" is a contraction for "it is."

- **The tuition did not increase this semester, but *it's* going to next fall.**

Use/Utilize

"Use" means to put into service. (Use is generally preferred over utilize)

- **The students *use* the computer lab daily.**

"Utilize" refers to the necessary conversion of something to make it useful.

- **Turkey litter is *utilized* to heat the greenhouse.**

Who/Whom

In most cases, the following steps will be useful in determining whether to use who or whom in a clause within a sentence:

Isolate the clause, starting with the who, whoever, whom, or whomever pronoun.

- **He did not tell me *(who, whom) Mr. Smith has selected*.**
- **Be courteous to *(whoever, whomever) telephones you*.**

Identify the verb in the clause. If a noun appears between the verb and the choice (who, whom), choose whom because it is in the objective case.

- **He did not tell me *whom* Mr. Smith has selected.** (object--noun--verb)

If there is no noun between the verb and the choice, choose who because it is in the nominative case.

- **Be courteous to *whoever* telephones you.** (object--verb)

Chapter Two. Grammar 1

Rules for forming the passive

Use the passive to **depersonalise** the topic in a sentence. The passive allows you to **omit I** or **We**. This strategy is especially common when writing up methods sections or describing procedures, since the passive places emphasis on the **steps** in the procedure and **how** it was carried out, but not on who did it.

TENSE	ACTIVE VOICE	PASSIVE VOICE
Present	We normally **heat** the water in a kettle. The program **calculates** the parameters.	The water **is** normally heat**ed** in a kettle. The parameters **are** calculat**ed** by/ using the program.
Simple past	We **heated** the water in a kettle. The program **calculated** the parameters.	The water **was** heat**ed** in a kettle. The parameters **were** calculat**ed** by/ using the program.
Present perfect	We **have heated** the water in a kettle. The program **has calculated** the parameters.	The water **has been** heat**ed** in a kettle. The parameters **have been** calculat**ed** by/ using the program.

Relative clauses

A **relative clause** is a group of words that is attached to a noun and serves to narrow the meaning of that noun. Relative clauses typically begin with a **relative pronoun** *which, that, or who.*

This section focuses on three areas of relative clause usage that can cause problems for writers:

1. Forming reduced relative clauses.

2. Forming prepositional structures with relative pronouns.

3. Identifying and punctuating defining and non-defining relative clauses.

Reduced relative clauses

Academic English prefers reduced relative clauses. This relative clause should be reduced to either its **past** or **present participle**, or even **deleted** if the main verb is the **verb** *to be*.

PAST PARTICIPLE (-ED)

Full relative clause (passive voice):

- Netscape allows administrators to implement programs **which are based** on Java.

Reduced relative clause (better):

- Netscape allows administrators to implement **programs based** on Java.

PRESENT PARTICIPLE (-ING)

Full relative clause (active voice):

- This study investigates the factors **which influence** the lifetime of telecommunication technology standards.

Reduced relative clause (better):

- This study investigates the factors **influencing** the lifetime of telecommunication technology standards.

DELETION OF VERB to be

Relative clause (verb to be)

- The atmospheric aerosols **that are in** heavily polluted areas have the potential to accelerate global warming.

Reduced relative clause (better):

- The atmospheric **aerosols in** heavily polluted areas have the potential to accelerate global warming.

STRATEGY FOR AVOIDING ENDING WITH A VERB

End verb (bad):

- Java is now the programming language **which developers** in North America **use** most.

Reduced relative clause (better):

- Java is now the programming language **used** most **by** developers in North America.

Prepositional relative clauses

- Always use which, not that directly after prepositions without a comma.
- Each species and genus of plants produces pollen grains that have a distinct shape. These shapes can be used to identify the **type of plant FROM WHICH** they came.
- A non-falsifiable theory is a **hypothesis FOR WHICH** no test can be devised.
- Global warming theories attempt to account for the documented rise in average global temperatures since the late 19th century and assess **the extent TO WHICH** the effects are due to human causes.
- Even without a detectable increase in global temperatures, greenhouse gases could change circulation and **weather patterns ON WHICH** most of the world's population depend for their day to day survival. One potential change is the drying out of the Amazon Basin.
- Recently, scientists have documented **trends IN WHICH** the natural timing of animal or insect life cycles changed and the **plants ON WHICH** they depended did not.

NUMERATOR + OF + WHICH

Always use **which** a **quantity expression** with *of*. Note that these expressions require numerators and are always divided from the rest of the sentence by a comma before and at the end of the relative clause.

- Finland has a diversity of ecosystem types**, each OF WHICH** can be broken down into many finer categories.
- The report details projected changes affecting everything from agriculture to breeding grounds for migratory birds**, many OF WHICH** are considered endangered.
- In 2002, the global temperature record was broken by a half degree Fahrenheit, which in climatic terms is a huge leap. Previous hot years**, the last two of WHICH were 1996 and 1998,** broke the record by small fractions of a degree.
- Each student room is equipped with broadband Internet access available**, the cost OF WHICH** is included within the residence fee.

Noun compounds

Nouns are the building blocks used to form sentences. Nouns combine with their modifiers to form noun phrases. Table 1 illustrates a number of noun phrases. Examples would include *portable devices*, *devices that detect bombs*, or a combination of both *portable devices that detect bombs*.

Table 2: Different options for modifying a noun to form complex noun phrases

	NOUN PHRASE		
	PREMODIFIERS	HEAD	POSTMODIFICATION
	Portable (adj.)	**devices**	that detect bombs.
1.	Prototype (noun)	**evaluation**	by end users.
2.	**Testing** (pres. part)	**equipment**	for wireless networks.
	Encryption (noun)	**algorithms**	**providing** (pres. part) higher security.
3.	**Downloaded** (past perf)	**files**	from the Internet.
	Video (noun)	**files**	**downloaded** (past part.) to the hard disk.
4.	Personal (adj.)	**data**	**entered** bythe user.

In spoken English, the most common modifiers of nouns are **adjectives**. Adjectives are a class of words that *describe, define, or quantify* nouns and are typically placed before, **premodify**, the noun:

- Laptop computers and PDAs are examples of **portable electronic** DEVICES.

Nouns used as adjectives

- The Netherlands has greatly reduced the use of **fossil FUELS** since the 1970s.

Network APPLICATIONS are capable of retrieving data from servers over a network.

Functional categories of noun compounds

Noun compounds can be divided into seven different categories on the basis of their function.

1. **Material**	**Copper** wire
What is it composed of?	(A wire composed of copper.)
2. **Mode of Operation**	**Friction** brake
How does it work?	(A brake that works by means of friction)
3. **Purpose**	**Air** filter
What does it do?	(A filter for cleaning air)
4. **Location**	**Laptop** computer
Where is it used/ found?	(A computer that can be used on a person's lap)
5. **Time**	**Summer** cottage
When is it used?	(A cottage that is used in the summer)
6. **Shape / form**	**Disc** brakes
What does it look like?	(Brakes that are shaped like round discs)
7. **Inventor / user**	The **Doppler** effect
Who discovered / uses it?	(An effect that was proposed by Christian Doppler)
	Passenger car
	(A car that is used by passengers)

English only uses a hyphen to indicate which word groups should be considered a *single modifying unit.*

hyphenated to avoid misunderstanding

Model-checking techniques

(= Techniques for checking [the validity of] a model)

Wrong: This validation is based on an evaluation **of** the engineers **of** the prototype.

Right: This validation is based on an evaluation **of** the prototype **by** engineers.

Head nouns that do not express *action*

Prepositional structures

NOUN COMPOUND **PREPOSITIONAL STRUCTURE**

A motion detection algorithm = an algorithm for the detection of motion.

Consumer product safety = the safety of the products for consumers.

Graphics Software packages = Packages of software for graphics.

Numbers + noun modifiers

Another unique structural feature of English noun compounds is the dropping of the final ***s*** in **plural noun modifiers** that represent a *unit of measure*.

NOUN PHRASE (plural) **NOUN COMPOUND (singular)**

A work shift that lasts **12 hours** = A **12-hour** work shift

A child who is **8 years** old = An **8-year-old** child

A bottle containing **1.5 liters** of water = A **1.5-liter** water bottle

Incubation at 65C for **10 minutes** = A **10-minute** incubation at 65C.

The nouns used in the names of certain engineering fields remain in the plural when acting as modifiers. Nevertheless, these are quite rare.

The telecommunication**s industry**

Material**s science**

The Medical Device Manufacturer**s Association**

Adverbs

Positioning adverbs in the sentence

In academic English, place adverbs **before** active verbs, after the verb to be, or in **mid-position** between the auxiliary verb and the main verb.

Before an active verb:

- The Earth's dry atmosphere mainly contains nitrogen.

After the verb to be:

- The increase in greenhouse gases **is MAINLY** a result of humans changing the natural patterns of vegetation and polluting the atmosphere.

Mid-position:

- The Earth's dry atmosphere **is MAINLY composed** of nitrogen.

Chapter Three: Grammar 2

1. Parallel Structure

Parallel structure means using the same form for words that have the same level of importance in a sentence or for a list of items that are joined by a coordinating conjunction, such as “and” or “or.”

- **The scientist collected, dried, and weighed the samples.**
- When preparing bulleted or numbered lists use the same word type (i.e., all nouns, all verbs) and maintain parallel structure. Capitalize the first word in a bulleted or numbered list.

2. Subjects and Verbs

A verb must agree with its subject, not with the words that come between the two.

- **The Club President, along with the officers, is going to the conference.**

Subjects joined by “*and*” usually take a plural verb.

- **Platinum, gold, and lead are available in the laboratory.**

When subjects are joined by “*or*” or “*nor*”, the verb agrees with the subject closest to it.

- **Cherries or two apple varieties have been used in the study.**

A verb agrees with the subject, even though in many cases the subject will follow the verb.

- **Educating the committee is difficult.**

Select quality verbs that demonstrate an action. A list of action verbs is provided in Appendix G.

- **take any → accept talk about → discuss went up →rose, increased**
- **leave out → exclude go with → select written up → composed**

3. Active and Passive Voice

Take responsibility by writing in active voice; use passive voice only when it is appropriate for emphasis or when you lack information.

- **The sound's reverberation struck the walls.**
- **The walls were struck by the sound's reverberation.**
- **The final project was finished by the team. (passive)**
- **The team finished the final project. (active)**

4. Cases of Pronouns

1. Nominative Pronouns: Used as a subject in the sentence (I, we, you, he, she, it, who, and they):

- **Mary and *I* will attend. The guard who let us in checked our identification.**

2. Objective Pronouns: Used as objects of verbs or prepositions (me, us, you, him, whom, and them):

- **He questioned Susan and *me* about the copyright. Whom did you ask?**

3. Possessive Pronouns: Used to show possession or ownership (my, mine, our, your, his, her, theirs, its, whose, etc.):

- **The Swartz Company may lose *its* best customer.**

5. Pronoun and Antecedent Agreement

1. A pronoun and its antecedent must agree in number.

- **The owner is concerned about sales, but *they* will rebound.**
- **The President or his advisers should devote part of their time to this issue.**

2. A parenthetical expression that appears between an antecedent and a pronoun does not influence the form of the pronoun used.

- **The accountant, rather than any of the other officers, will be asked for his or her opinion of this purchase.**

3. For clarity, make pronoun usage clear and understandable by avoiding vague references.

- **I worked hard on the experiment, and it was difficult.** Does the writer want us to consider the experiment as difficult, the work that was done as difficult, or that it was difficult to work hard?

6. Compound Words

A compound word conveys a unit that is not as clearly conveyed by separate words.

1. Use a hyphen to connect elements of compound numbers from twenty-one to ninety-nine and in adjective compounds with a numerical first element. The hyphen not only unites but also separates the component words.

- **7-hour day, 3-inch ruler, eighty-five.**

2. Use a hyphen after the "e" to designate "electronic":

- **e-mail, e-commerce, e-article**

3. Omit the hyphen when words appear in regular order and the omission of the hyphen causes no confusion in sound or meaning.

- **palm oil, eye opener, living costs**

4. Use a hyphen for clarification when four nouns appear in a row.

- **A sand-filtered purification system. The end-of-year report.**

7. Capitalization

1. Capitalize the name of a particular person, place, or thing, as well as an adjective that refers to a specific name.

- **Canada/Canadian, Tibetan Alpacas**

2. Generally capitalize a noun that is followed by a number or letter used to identify a unit or division.

- **Lot 14, Tract 833, Volume III, Chapter 8, Policy No. 12345, Catalog No. 214.**

3. Capitalize the names of courses of study only if they are derived from proper nouns.

- **English, shorthand, history, German, Business Mathematics 121**

4. All words except articles (a, an, the), conjunctions, and short prepositions are capitalized in names or titles that consist of more than one word.

- **Official Draft of the NBA; the Eastman Kodak Company**

5. Do not capitalize classes (freshman, sophomore, junior, or senior), degrees (doctorate, doctor's, master's, bachelor's, baccalaureate), or seasons (spring, summer, fall, winter), unless they appear at the beginning of a sentence or in a headline.

8. Numbers as Words

1. Generally spell out isolated numbers from one to ten.

- **The discussion lasted for ten minutes.**

2. Spell out a number that introduces a sentence. If the number is long, recast the sentence to avoid awkwardness.

- **Twenty people attended the lecture.**

3. Spell out common fractions that are used alone. However, use figures in writing a mixed number.

- **He refused to accept his one-fourth share.**
- **The hike was 10 ½ miles long.**

4. When rounding numbers, spell out million or billion to make reading easier.

- **This tax legislation will increase revenue by $7 million.**

9. Numbers – Text or Digits

1. Generally use numerals to express all exact numbers above ten.

- **The corporate file has been missing for 31 days.**

2. If several numbers in a sentence perform similar functions, express them uniformly. If one is written as a figure, write all as figures.

- **The inventory shows 21 ranges, 9 refrigerators, 37 washers, and 10 dryers.**

10. That and Which

- ❖ Generally "that" defines and restricts; "which" provides additional information. "That" is used restrictively to narrow a category or identify a particular thing. The information following "that" is critical to the reader's understanding.
- **The article *that* was printed in the newspaper yesterday is inaccurate.**
- ❖ "Which" is used nonrestrictively to add some descriptive but incidental information and is preceded by a comma, a dash, or a parenthesis.
- **The ballerina was dancing around the room wearing a baseball cap, which is not something you would expect.**
- ❖ "Which" is used restrictively only when it is preceded by a pronoun.
- **Realize that you will be asked for your opinions about topics in which you do not feel completely comfortable.**
- **There are other factors that will impact funding, which have garnered little interest in the audience.**
- The "*which*" introduces a nonrestrictive clause, which simply provides additional information to the reader. The "*that*" clause contains information that is vital to the context.

Chapter Four. Punctuate Properly 1

Punctuation is used to clarify the sentence structure and prevent misreading. A comma is used to prevent reading "general errors" in the following sentence.

- **In general, errors fall into two categories …**

In the following example, simple words run together and cause confusion.

- **In this experiment error could have been introduced…**

Adding a comma prevents confusion.

- **In this experiment, error could have been introduced…**

Comma

Commas are the smallest break in sentence structure and indicate a slight pause. They clarify the meaning of a sentence and are used:

1. To separate items in a series. The Chicago Manual of Style requires a comma after each item in a series, including before the conjunction, including both "and" and "or."

- **The experiment was conducted quietly, quickly, and satisfactorily.**
- **Please contact Dr. Jones at his office, laboratory, or home.**

2. In a series of clauses.

- **Included within this report are theory and methods of analysis, equipment and experimental setup, procedure guidelines, results, a discussion of results, and conclusions.**

3. Before a coordinate conjunction (and, or, but, nor, for, so) that joins two main (independent-equal elements) clauses in a compound sentence, do not use a comma if the second part of the sentence cannot stand alone.

- **The final session ended, and the students went home.**

- **John saw the car coming towards the bike, so he started to scream.**
- **The students counted the proceeds and are pleased with the results.**

4. To separate the items in a date or an address.

- **On May 15, 2005, we moved.**

5. After an introductory adverb clause.

- **If we advertise our product, our sales will increase.**

6. To set off nonrestrictive (not necessary) clauses and phrases.

- **The four articles, all of which were published in important journals, explained the details of her work.**

7. To set off parenthetical elements: as a result, for example, however, if necessary, indeed, it seems, of course, therefore, nevertheless.

- **This, indeed, is what we expected from the experiment.**
- **All of the test results, it seems, will have to be reanalyzed.**

8. To set off parenthetical expressions:

- **Susan, on the other hand, is reserved.**

9. To emphasize words that are independent of a main clause or clearly nonrestrictive. Such items may be divided into several categories: Direct address, appositives, interjections, quotations, abbreviations that follow names to indicate such things as titles and degrees, contrasting expressions, and tag questions.

- **Dr. Jones, chair of the search committee, called the meeting to order.**

10. To clarify the meaning of a sentence.

- **The book *My Life*, written by Mr. Smith, was a best seller.** (Nonrestrictive)
- **The book written by Mr. Smith was a best seller.** (Restrictive)

Colon

Colons link related thoughts, but one of those thoughts must be able to stand alone as a sentence.

1. The series of elements following the colon amplifies what precedes the colon.

- **The lab needed two more pieces of equipment to fulfill the contract: a vise and a drill press.**

2. Colons may be used in place of a period to introduce a series of related sentences.

- **He had to make a choice: Should he tell the truth? Or should he protect his family?**

3. When a colon precedes a complete sentence, capitalize the first word after the colon.

- **The faculty board made a final decision: Students' submitted work must meet technical writing standards throughout their curriculum.**

4. Colons are also used to introduce lists.

- **Professor Smith's qualifications include:**

a. Designing machinery systems

b. Evaluating financial markets

c. Working with students

5. When used in text with equations, colons are used after the words follow, follows, and following.

- **Equation (7) is transformed into the following:**

x + y = 32.7

6. When used in a URL address, no space precedes or follows the colon.

- **http://www.egr.msu.edu**

Semicolon

Place a semicolon halfway between the comma and the period in force and restrict the use of a semicolon to the following situations:

1. Before a transitional adverb (however, thus, hence, indeed, accordingly, besides, therefore).

- **The brochures have already been printed; however, they have not yet been distributed.**

2. Between two closely connected but independent clauses of a compound sentence that are not joined by a coordinating conjunction (and, but, or, nor, for, yet, or so).

- **Make sure to select the correct term; review the list of commonly misused words in Appendix E.**

3. Before the coordinating conjunction in a compound sentence to provide separate emphasis.

- **It was the resistor; despite all of the modifications, it did not work.**

4. To separate items in a series when the items themselves contain commas.

- **The four most important dates in the firm's history are June 12, 1888;**
- **May 10, 1920; October 4, 1939; and December 1, 1982.**

5. Before a coordinate conjunction that separates two main clauses, and if there are commas within the clauses:

- **His determination, his courage, and his sincerity could not be denied; but his methods were often questioned.**

Apostrophes

Apostrophes indicate a contraction or a possessive case.

In informal English, apostrophes are used to shorten a phrase, forming a contraction:

I am **I'm**

They are **They're**

It is **It's** (NOTE: *its* is the possessive form--without the apostrophe)

Contractions should be used in technical writing.

Use an apostrophe to indicate possession by observing the following rules:

1. Form the possessive case of a singular noun or number by adding an apostrophe and s ('s):

- **Sue's notebook. 2005’s hurricane season.**

2. Form the possessive case of a singular noun that has two or more syllables and ends in an s or z sound by adding only an apostrophe:

- **The waitress' manner. The crisis’ origin**

3. Form the possessive of a regular plural noun (one ending in s) by adding only an apostrophe after the s:

- **The boys' accounts**

4. Form the possessive of an irregular plural noun (one not ending in s) by adding an apostrophe and s:

- **Men’s hair**

5. Form the possessive for names by adding an apostrophe and an s even when the person's name ends in s or another sibilant. Two traditional exceptions include Jesus' and Moses'.

- **Swartz's home. Marx's property. Hertz’s rent a car.**

6. When two linked nouns possess the same thing, only the second noun is written in the possessive form. However, if the linked nouns possess different entities (described as one in the sentence), each is written in the possessive form.

- **Bert and Ernie’s dogs are here.** (The dogs collectively belongs to both Bert and Ernie)
- **Bert’s and Ernie’s dogs are here.** (The dogs belong to different entities.)

7. Do not use an apostrophe to indicate plurals, including the plurals of acronyms and abbreviations unless the result is confusing, for example U’s and Us.

- **There are three 6s in that number. There were four PhDs in last year's class.**

8. Apostrophes are required for bachelor's degree and master's degree, because possession is indicated.

Quotation Marks

1. Use quotation marks to enclose direct quotes.

2. Use a single quotation mark when a quote is inside another quote.

3. Place periods and commas inside quotation marks.

- **He said, “I will review and edit my documents carefully.”**
- **“I will always ask my peers to review my papers before turning them in,” said the student.**

4. Colons and semicolons are placed after the quotation marks.

- **You said, “I will turn in my work before leaving”; it was not in my mailbox.**

5. A question mark goes outside the quotation marks when the entire sentence is a question and inside when the quoted phrase is a question.

- **When Joe asked the question, “Did you see the roach cross the room?” the roach appeared before our eyes.**
- **Did the delivery person say, “I left the package in the basement”?**

6. An exclamation point is placed inside the quotation mark only when it is part of the quoted material.

- **The student cried, “The power is on!”**

Chapter Five. Punctuate Properly 2

Use a comma in front of *coordinating conjunctions* such as **and, but, nor, yet, or**, and **so to combine two complete sentences.**

SENTENCE 1 + [COORD. CONJ.] + SENTENCE 2:

As a result of global warming, the oceans will warm**, AND** glaciers will melt.

NASA has used fuel cells to generate electricity in spacecraft since the 1960s**, BUT** more research is needed to make them durable and cost-effective for use in cars, homes, or businesses.

Hydrogen is non-toxic and non-poisonous. It will not contaminate groundwater**, NOR** will a release of hydrogen contribute to atmospheric pollution.

Hydrogen fuel cells are safe and effective**, YET** the technology is still too expensive for the mass market.

Hydrogen is the most plentiful gas in the universe**, SO** there is no fear of this energy source ever running out.

When both sentences have the **same subject**, English tends to delete the second subject, and no comma is then placed before the coordinating conjunctions.

Without comma:

These schemes provide a solution to current traffic [no comma] **AND** are easy to implement

Different subjects:

Hydrogen fuel cells are safe and effective**,**	**BUT** this technology is still too expensive for the mass market.

Same subject:

Hydrogen fuel cells are safe and effective **BUT** still too expensive for the mass market.

;

Use a comma to separate *non-defining relative clauses* from the main clause

English has two types of **relative clauses: non-defining** (also called: commenting, non-defining) and **defining** (also called: essential, restrictive) relative clauses. This distinction is important if you are to punctuate these correctly in English. A comma is only needed when the relative clause contains non-defining information.

The Carlson company offered cash to **SURFERS WHO** agreed to look at advertisements.

In **formal definitions**, the relative pronouns **which**, **that** and **who** are not usually introduced by a comma, because they are essential to the meaning and define the class:

- A catalytic converter is a **device** in the vehicle exhaust system **WHICH/THAT** chemically changes pollutants, such as carbon monoxide (CO), hydrocarbons (HC), and nitrogen oxides (NOx) into harmless substances.
- A scientist is a **person WHO** is expert in an area of science and uses scientific methods in research.
- A limited partnership is a **business structure IN WHICH** the liability of one or more of the partners is limited to the amount invested by him.

Non-defining relative clauses comment or give extra details on the topic and can thus be omitted from the sentence without losing the main meaning of the sentence. Non-defining relative clauses must also be separated from the rest of the sentence by punctuation–most commonly by commas.

- **Mexican food THAT/WHICH is heavily spiced with chili** gives me indigestion.
- **Mexican food, WHICH is heavily spiced with chili,** gives me indigestion.

To make clear whether the information is necessary to describe the noun in a defining clause, use **that** or **which** with NO comma. To add extra information in a non-defining clause, use **which** and be careful to add a comma.

***Which* or *that*?**

While **that** can only be used to introduce defining information, **which** is used to introduce **both** defining and non-defining information. Some grammarians still, however, insist on limiting which to only non-defining relative clauses. In the future, those non-energy sectors most dependent on energy will suffer the greatest loss in production**, as shown in Table 1**.

Appositives

Use a comma for *appositives* (to re-name something mentioned before)

An **appositive** is a noun or noun phrase that renames a previous noun by identifying, defining, or explaining it.

The core of this paper is a case analysis of how **a large UK retailer, J. SAINSBURY,** used VCA to manage the supply chain in cooperative relationships with suppliers. **NOKIA, the world's top cell phone maker,** on Tuesday launched the first pre-commercial 3G network in Toulouse, France.

Appositives commonly present **examples, explanations, and definitions, which** help to identify or explain a concept. In the examples below, notice how leaving out the words enclosed in commas would not change the message. Often the appositive is introduced by **namely, for example, that is, such as, including, i.e.**, or **e.g.** Examples in academic English are typically expressed as appositives which take a comma both before and after the example(s).

Use a comma to separate sentence connectors and other adverbs from the subject

To avoid confusion and to help the reader to quickly find the subject of a sentence, English uses the comma to clearly **mark and separate** any information that comes at the beginning of the sentence from the subject. Typical words that can come before the subject include **sentence connectors, attitudinal adverbs** (*words signalling the writer's attitude*), and **time adverbials.**

Attitudinal adjunct (e.g., *Surprisingly, Undoubtedly, Clearly*)

UNFORTUNATELY, what is meant by the term varies according to the field of study.

Time adverbals (e.g., *Currently, Finally, Next, Second(ly)*)

RECENTLY, engineering systems have begun to have almost biological levels of complexity.

Introductory phrases and clauses

Use a comma to separate an introductory phrase from the subject

Introductory prepositional phrases (In, On, At, Of, With, For)

IN firms of all sizes, a basic aim of management accounting routines is to control vital areas and to monitor performance.

Introductory infinitive phrases (To analyse)

TO examine these issues, we adopt transaction cost economics (TCE) as our basic frame of reference.

In Figure 10, the difference between tamper-proofing and other techniques is characterized.

To send data, IR remote controls use a sequence of light bursts with different delays.

The difference between tamper-proofing and other techniques is characterized **in Figure 10**.

IR remote controls use a sequence of light bursts with different delays **to send data**.

Subordinate clauses

Use a comma before and after subordinate clauses to mark the beginning of the subject

Table : Subordinate conjunctions

Function	Subordinate conjunctions	Example
TIME	after, before, when until, since, when	**AFTER the United States withdrew its support from the Kyoto Accord,** there has been little hope of diminishing global emissions of greenhouse gases in the near future.
PLACE	where, wherever	**WHEREVER you go,** Bluetooth wireless technology connects your devices without adding clutter to your desktop.
MANNER	as, as if	**AS you enter the room,** you will notice immediately that. . .
CAUSE	because, since, as	**BECAUSE CH4 is also a greenhouse gas,** it can be regarded as making both a direct and an indirect effect on the greenhouse effect.
CONDITION	if, unless	**IF you enter the factory,** you are required to wear a hard hat.
PURPOSE	so that, in order that, in order to, for	**IN ORDER TO stabilize concentrations of nitrous oxide at present day levels,** an immediate reduction in global emissions by 80% would be needed.
CONTRAST	although, while, whereas	**ALTHOUGH there are dozens of greenhouse gases,** a handful of dominant ones have attracted the most attention.

- A common exception to this rule are the contrastive and causative subordinators, and more specifically **while**, **since**, and **as** because only the use of the comma distinguishes them from their other meanings expressing **Time.**
- There is no universal agreement among scientists and climatologists on the potential impacts of an increase in the average temperature of the Earth**, although it has been hypothesized that it could lead to changes in the global climate.**

Listing

Items in a list: Use a comma to separate items in a list

In **British English, and** and **or** are usually not preceded by a comma before the final item in a list, whereas in **American English** a comma before the final **and/or** is compulsory.

- The Family Filter blocks all harmful **image files, video files, SPAM,** and **internet pages** from your children's computer.

Coordinate adjectives

Use a comma to separate two or more equivalent adjectives

Many languages feel comfortable using *and* between two adjectives that are considered to be equivalent. Although this use might be heard in spoken English, the written form totally avoids this use of *and*.

- Similar to many other initially **exotic, expensive** technologies, **CD-Recordable** drives have become everyday tools for most users.

Cumulative adjectives

Cumulative adjectives are those adjective pairs that fail the two-step test and should therefore appear in the same **fixed order**, **without a comma**, and **without *and***.

. . . modern **and** electronic **devices**. . .*!* NO!

. . . modern electronic **devices**. . . (original) *!* YES!

. . . electronic modern **devices**. . . (reversed) *!* NO!

Resultative -ing clauses

Use a comma before a resultative -ing clause

A common way to indicate the *result* of an action is to use a causative verb in the -ing form separated by a comma.

Any significant greenhouse warming could cause a rapid melting of polar ice**, RESULTING in a rise in sea level and the consequent flooding of coastal areas**.

The fields of nanoscience and nanoengineering have developed in recent years**, LEADING to unprecedented understanding of the fundamental building blocks of all physical things**.

The same meaning could be expressed in less academic language as the following:

WITHOUT -ING CLAUSE OF RESULT

Any significant greenhouse warming could cause a rapid melting of polar ice**, WHICH** would result in **a rise in sea level and the consequent flooding of coastal areas**.

Colon [:]

Introducing a list

Use a colon after an independent clause to introduce a list

- **The lab report consists of six sections:** introduction, background, engineering theory, experimental setup, procedure, and analysis.
- **The six main sections of a lab report ARE:** introduction, background, engineering theory, experimental setup, procedure, and analysis.

- **The lab report consists OF:** introduction, background, engineering theory, experimental setup, procedure, and analysis.
- **The six main sections of a lab report ARE** the introduction, background, engineering theory, experimental setup, procedure, and analysis.
- **The lab report consists OF** introduction, background, engineering theory, experimental setup, procedure, and analysis sections.

Introducing a summary or explanation

Use a colon between *independent clauses* if the second summarizes, explains or amplifies the first.

The purpose of this paper is twofold**:** (1) to determine tasks associated with current injury, illness, and fatality trends in the mechanical contracting branches of the construction industry and (2) to identify current safety practices associated with the reduction of risk of these injuries, illnesses, and fatalities. (explains)

Often the titles of research articles and reports use this function of the colon to give further details explaining the contents of the reports.

- Laser Welding Induced Alignment Distortion in Butterfly Laser Module Packages : Effect of Welding Sequence.

Introducing a summary or explanation

Use a colon between *independent clauses* if the second summarizes, explains or amplifies the first.

Transactions can be scored discriminatingly on three dimensions: (1) asset specificity; (2) uncertainty (including complexity, which is similar to uncertainty in its effects); and (3) frequency.

Before connectors in compound sentences

Use a semicolon before introductory words

- During the development of the various engineering disciplines, considerable overlap has occurred among the different fields**; FOR EXAMPLE,** chemical engineering and mechanical engineering are both concerned with heat transfer and fluid flow.

PROBLEM (3 consecutive commas): ☹

Similar to Sweden, Finland has an arctic climate, AND, THEREFOR polar bears migrate as far south as Helsinki in search of prey.

SOLUTION (Replace the "and" with a semicolon): ☺

Similar to Sweden, Finland has an arctic climate; THEREFORE, ma bears migrate as far south as Helsinki in search of prey.

however, moreover, therefore, in addition, nevertheless,

First, with few exceptions (Balderjagn, 1988; Schahn & Holzer, 1990; Grunet & Kristensen, 1994), many earlier studies failed to investigate the impact of sociodemographic variables on all components of environmental consciousness**;** namely, knowledge about green issues, attitudes towards environmental quality, and levels of environmentally sensitive behavior.

Hyphen [-]

1. Compound nouns: Hyphens can join two or more words to form new **'nouns'**.

2. Compound adjectives: Hyphens can indicate that two or more words act as an **'adjective'** before a noun.

3. Words formed from affixes: Hyphens can be used to join an **'affix'** to a word

4. Numbers and fractions: Hyphens are used to form **fractions** (one-third) and **compound numbers** (from twenty-one to ninety-nine).

5. Avoiding ambiguity: Hyphens are used to make a clear distinction between words that would otherwise be confused *re-form* (to form again) and *reform* (to improve by change).

Compound nouns

Most compound nouns were initially written as separate words. As these compounds gained popularity, they next appeared joined by a hyphen. Later, as they became firmly established in thelanguage, the hyphen disappeared, resulting in closed-form compound nouns.

Open form		**Hyphenated form**		**Closed form**
fire fighter (1903)	→	fire-fighter	→	firefighter
work station (1931)		work-station		workstation
data base (1962)		data-base		database

Nouns formed from phrasal verbs

Although phrasal verbs (verb + preposition), such as *take off*, *take over* and *set up*, are not hyphenated, the nouns formed from these verbs are hyphenated, or with increasing use become written as one word. Thus, the hyphen helps readers to distinguish between the verb and noun forms.

	Phrasal verb		**Compound noun**
	to set up	→	a set-up (setup)
	to bail out		a bail-out (bailout)
	to pay off		a pay-off (payoff)
	to break in		a break-in
HYPHENATED			**NOT HYPHENATED**

A man-eating shark	A man eating shark
(a carnivorous fish)	(a carnivorous male human)
New **age-discrimination** rules	**New-age** discrimination rules
(new rules regarding discrimination according to age)	(rules about discriminating against the philosophy of the New Age movement)

Mobile phones are bringing video games to a broader audience.

[Noun] [Noun] [Head noun]

SEGA is a major player in the video-game industry.

PREMODIFIER

There is a growing need for **communication networks** that are **reliable** and can achieve **high performance.**

[Adj] [Noun] [NOUN COMPOUND]

There has been rapid growth in the need for **reliable,** high-performance communication networks.

PREMODIFIER

RELATIVE CLAUSE:

The Webopedia site offers definitions of many **terms that are related to computers**

REDUCED RELATIVE CLAUSE: **terms related to fields.**

NOUN COMPOUND: [Noun] [Past Part][Noun]

The Webopedia site offers definitions of many **computer–related terms.**

PREMODIFIER

FULL-FORM RELATIVE CLAUSE:

Nanotubes are expected to form outstanding **materials that emit fields.**

REDUCED RELATIVE CLAUSE: **materials emitting fields.**

NOUN COMPOUND: [Noun][Pres Part][Noun]

Nanotubes are expected to form outstanding **field–emitting materials.**

PREMODIFIER

[Adv] [Past Part] [NOUN COMPOUND]

Europe has a high population density and most EU nations have **well–established transportation systems.**

PREMODIFIER

Premodification	**Postmodification**
A **quickly-moving manager**	A vehicle that **moves quickly**

The original image is 30KB in size, while the **version at a width of 200 pixels** requires only 10KB.

[Num][Cnt] [Noun]

The original image is 30KB in size, while the **200-pixel version** requires only 10KB.

PREMODIFIER

Premodification		**Postmodification**
A **four-day** week	→	A week that lasts only **four days.**
A **three-step** sequence		A sequence that consists of 3 **steps.**

1. Use a hyphen to avoid doubling or tripling consonants and vowels. (**anti**-immune, **de**-energize)

2. Use a hyphen to separate **self-, ex-, all-, vice-, quasi-** and the suffixes **-like, -wise** and **–elect** from the main word. (**self**-respect, **ex**-wife, **all**-inclusive)

3. Use a hyphen when the main word is a number or a proper noun (nouns that are capitalized, such as names and nationalities). (the **post-K**ekkonen era, **non-F**innish)

Numbers and fractions

25% → **twenty-five** percent

133 AC → **One hundred** and **thirty-three** euros

3. A number beginning a sentence.

- **Thirty-five** patients with chronic fatigue syndrome were followed for periods of up to eight years.

4. The shorter of two numbers used together.

- **fifteen** 33-cent stamps. 150 **twenty-cent** coins.

5. Isolated fractions or indefinite numbers in sentence.

- Nearly **forty** apartment owners, almost **three-fourths** of the residents, took part in the last building society meeting.

Avoiding ambiguity

Hyphenated	Not hyphenated
re-form (to form again)	**reform** (to restructure)
re-cover (to cover again)	**recover** (to get better after an illness)
re-sent (sent again)	**resent** (to feel bitter about something)
re-press (to iron again)	**repress** (to hold down)
re-sign (to sign again)	**resign** (to hand in one's notice)

.

foreign-sales secretary	foreign **sales secretary**
(the secretary takes care of sales to foreign countries)	(*the secretary who takes care of sales is foreign*)
small-business entrepreneurs	small **business entrepreneurs**
(*the businesses are small*)	(*the entrepreneurs are small*)
extra-curricular activity	extra **curricular activity**
(*student activities in addition to their actual coursework*)	(*further coursework tasks for students*)

Chapter Six. Connectors

What are connectors?

If you want to write well, you need to pay attention to many things. Grammar is the thing that comes to mind first perhaps, but there are several other things just as–or even more–important. In fact, there are three global considerations–audience, purpose, and structure–that you need to consider no matter what you are writing.

In this unit, we are going to look at one way of guiding your audience: using special words and phrases to help readers understand how ideas and sentences are connected to each other. These words and phrases are often called logical connectors, linkers, signposts, or connectives, but we'll call them connectors here. This unit focuses on signposts that indicate additive, contrastive, and causative the relationships either between elements within a single sentence (e.g., conjunctions, subordinators and prepositions) or across sentences (e.g., sentence connectors, nouns, adjectives).

Additive connectors

Additive connectors can be grouped into four grammatical classes:

- Sentence connectors commonly occur at the beginning of a sentence. They are physically separated by a comma to mark their special role and show the relationship between that sentence and previous sentences.
- Prepositions combine only with noun phrases and gerunds (-ing) forms to link the current sentence with earlier ideas.
- The category of other linkers includes adverbs, co-ordinate conjunctions, and non-finite clauses that function to join ideas within a single sentence.

- Special adjectives indicate that another example of something mentioned earlier is about to follow.

Table. Types of additive connectors.

Sentence connectors (Between sentences)	**Prepositions** (Within sentence)	**Other linkers** (Within sentence)	**Adjectives** (Within sentence)
Moreover,. . .	In addition to . . . , . . .	and	(an)other
In addition,. . .	. . . , as well as. . .	also	
Furthermore,. . .	Similar to . . . , . . .	as well	
Further,. . .	Like . . . , . . .	. . . , with. . . -ing	
Additionally,. . .		. . . , as + [aux verb]	
Likewise,. . .		not only. . . , but also	
Similarly,. . .		both. . . and	

Prepositions

In addition to. . . , . . .	. . . , as well as. . .	Like. . . , . . .	Similar to. . . , . . .

Unlike sentence connectors which connect 2 separate sentences, **prepositional connectors** are used **within** the sentence to signal the **adding** of extra information. In addition, only prepositions can combine with nouns and noun phrases as well as gerund (-ing) forms.

Other connectors

and	. . . , with. . . -ing	. . . , as well	not only. . . but also
also	. . . , as + [auxiliary verb]	both. . . and	

- **These schemes** provide a solution**, AND they** are easy to implement.
- **These schemes, BOTH** provide a solution**, AND they** are easy to implement.
- These schemes **provide** a solution **AND are** easy to implement.
- These schemes **BOTH provide** a solution **AND are** easy to implement.

- These schemes **NOT ONLY provide** a solution **BUT are ALSO** easy to implement.

Adjectives

(An)other	(A) further	(A) similar

Contrastive sentence connectors

Contrastive connectors can be grouped into four grammatical classes, as shown in the box below.

_ **Sentence connectors** (traditionally called sentence adverbs) occur at the beginning of a sentence to link one sentence containing a cause with the effect or result in another one.

_ **Conjunctions** (also known as adverbs and co-ordinate conjunctions) are those signposts that function within a single sentence to link causes with effects.

_ **Subordinators** (also known as subordinate conjunctions) usually combine with full clauses; however, they can also be used with noun phrases when the main clause has a 'human' subject. Subordinators mainly differ from the other signposts in that they help to move the stress to ideas expressed in the main clause.

_ **Prepositions** combine with noun phrases and gerund (-ing) forms to contrast ideas within the same sentence.

Table. Types of contrastive connectors

Sentence connectors (Between sentences)	**Conjunctions** (Within sentence)	**Subordinators** (Phrase linkers)	**Prepositions**
However,. . .	but	Although. . .,. . .	In contrast to + noun,. . .
Nevertheless,. . .	yet	(even) though. . .,. . .	Contrary to. . .,. . .
Nonetheless,. . .	nor	While. . .,. . .	Unlike. . .,. . .
On the other hand,. . .	albeit	Whereas. . .,. . .	Despite. . .,. . .
In contrast,. . .			In spite of. . .,. . .
Conversely,. . .			Notwithstanding. . .,. . .
On the contrary,. . .			Instead of. . .,. . .
Alternatively,. . .			
Instead,. . .			

Many of these connectors may overlap in meaning, although they have subtle differences in uses and meaning. For example, connectors differ in the things that are contrasted. Some connectors are used to express contrasts between choices and others' viewpoints, while some tend to come only after negative statements. Contrastive connectors can be divided into four groups:

1. **Concessive** connectors introduce something unexpected or surprising in view of what was said earlier. (*However,. . . and Nevertheless / Nonetheless,. . .*)

2. **Adversative** connectors introduce OR point out differences.

(*On the other hand,. . . ; In contrast / By contrast,. . .* ; Conversely,. . .)

3. **Argumentative** connectors challenge or dispute the 'truth' of a widely-held view.

(*On the contrary,. . .*)

4. **Replacive** connectors eliminate earlier topics from discussion and replace them with new ones.

(*Instead,. . . and Alternatively,. . .*)

Contrastive conjunctions

. . . , but. . .	. . . , yet. . .	neither/not. . . , nor. . .	. . . , albeit. . .	nor. . .

Positive (+)Negative (–)

These schemes provide a solution**, BUT** they are **not** easy. (with comma)

These schemes provide a solution **BUT** are **not** easy. (no comma)

These schemes provide a solution**, ALBEIT a difficult one,** to our current traffic problems.

Negative (–) Positive (+)

These schemes are **not** easy to implement, **BUT** they are **NEVERTHELESS** technically compatible.

Negative (–) Negative (–)

These schemes are not technically compatible**, NOR are they** easy to implement.

These schemes are neither technically compatible**, NOR are they** easy to implement.

Positive (+)Positive (+)

These schemes provide a solution**, AND** they are easy to implement.

These schemes provide a solution **AND** are easy to implement.

Contrastive subordinators

Although. . .,. . .	(Even)though. . .,. . .	While. . .,. . .	Whereas. . .,. . .

Subordinate connectors function to introduce information that contrasts or differs from information given in the same sentence. This class of contrastive connectors can be placed either at the beginning, middle, or the end of a sentence, separated from the rest of the sentence by a comma.

BEFORE THE MAIN CLAUSE:

- **ALTHOUGH it is twice as far away from the Sun as Mercury,** Venus is the planet with the hottest surface temperature day or night.

AFTER THE MAIN CLAUSE:

Venus is the planet with the hottest surface temperature day or night**, ALTHOUGH it is twice as far away from the Sun as Mercury.**

WITHIN THE MAIN CLAUSE:

Venus**, ALTHOUGH twice as far away from the Sun as Mercury,** is the planet with the hottest surface temperature day or night.

Similar to the contrastive sentence connectors, the subordinators can be divided into two groups.

1. **Concessive subordinators**: signal that something is unexpected or surprising in view of what has been said earlier.

(although. . . , ... and (even)though. . . ,. . .)

2. **Adversative subordinators**: introduce or point out differences between two different things.

(While. . . ,. . . and Whereas. . . ,. . .)

Contrastive prepositions

- **ALTHOUGH the number of 2-income households has doubled since the early 1970s,** average wages have declined by 15% in the United States.
- **DESPITE doubling the number of 2-income households,** the U.S. economy has been unable to avoid a 15% drop in average wages since the early 1970s.

Table: Types of causative connectors.

Sentence connectors (Between sentences)	**Subordinators** (Within sentence)	**Prepositions** (Within sentence)	**Verbs**	**Nouns**
Thus,	since	because of	leads to	The cause of
Therefore,	because	due to	results in	The reason for
Hence	as	as a result of	causes	The effect of
Consequently,	in that	as a consequence of	contributes to	
As a result,		owing to		a result of
As a consequence,		On account of	results from	a consequence of
For this reason,			arises from	the effect of
Accordingly,			stems from	

These sentence connectors function to introduce the result (because of this) of a fact, action or event given in previous sentences.

- Levels of greenhouse gases have increased dramatically **BECAUSE OF human activities**.
- **BECAUSE OF human activities**, levels of greenhouse gases have increased dramatically.
- It is estimated that the Earth's average temperature has risen by 0.5 to 0.6_C since 1880 **DUE TO emissions of greenhouse gases from human activity**.
- **DUE TO emissions of greenhouse gases from human activity,** it is estimated that the Earth's average temperature has risen by 0.5 to 0.6_C since 1880.
- **OWING TO their molecular structures,** certain gases like carbon dioxide and water vapor are essentially transparent to visible light but absorb IR radiation very strongly. Such compounds are sometimes termed 'greenhouse' gases because they absorb the scattered IR radiation and tend to raise the temperature of the atmosphere by trapping solar energy.

Causative verbs

CAUSE → EFFECT			EFFECT → CAUSE	
leads to	accounts for	affects	results from	ascribes to
results in	triggers	influences	arises from	attributes X to
causes	induces	contributes to	stems from	
produces	gives rise to	brings about		

The verbs expressing causative relations can be divided into two groups:

1. **cause-effect verbs** that state the cause before the effect, and

2. **effect-cause verbs** that place the effect before the cause.

Typical verbs that **start with an effect** and then introduce the cause include **lead to, result in, cause, produce, account for, trigger, give rise to, affect, influence, and contribute to.**

CAUSE! EFFECT

The major natural greenhouse gases are water vapor, which **causes** about **60% of the greenhouse effect** on Earth, carbon dioxide (about 26%), and ozone.

To move in the opposite direction, from an effect to the **cause**, you can use the verbs **result from, arise from, stem from, ascribe to, and attribute to**.

	CAUSE → EFFECT	
Greenhouse gases (GHGs)	CAUSE	the greenhouse effect.
	EFFECT → CAUSE	
The greenhouse effect	IS CAUSED BY	greenhouse gases (GHGs)

Causative nouns

the cause of	the effect of	a result of	the reason for
the influence of	the impact of	a consequence of	

Five nouns can function with the verb to be to signal cause/effect relations in English. The main patterns used with these nouns are:

1. The cause of [RESULT] is [CAUSE]. . .

2. The reason for [RESULT] is [CAUSE]. . .

3. The effect of [CAUSE] is [RESULT]. . .

4. [CAUSE] had an influence on [RESULT]. . .

5. The impact of [CAUSE] on [RESULT]. . .

6. [RESULT] is the result of [CAUSE]. . .

7. A consequence of [CAUSE] on [RESULT] is. . .

Chapter Seven: Use of Articles

Although the articles **a, an**, and **the** are very small words, they can cause considerable problems for students of English—even advanced students. These three words are the most common words in the English language and always occur before a noun to indicate a particular viewpoint of that noun.

Many foreign writers may not realize that their choice of an article (or the lack of one) communicates a particular viewpoint of the noun referred to. To use the articles correctly, you need to be able to distinguish between countable and uncountable nouns; to determine whether a noun refers to a general or specific instance of the concept; and to understand how your perspective can become definite due to either the unique nature of noun the itself, or the adjectives and modifiers that accompany the noun.

Countability

The largest group of nouns refers to things that can be counted. We call these **count nouns**. These nouns have both singular and plural forms (computer—computers). In English, you cannot say an equipment or equipments, since this word is considered to be uncountable, or an **uncount noun**, while some nouns can function as both countable or noncountable nouns, which are commonly known as two-way nouns.

Count nouns

Plural nouns

Some count nouns in English can occur only in their plural forms:

contents	facilities	instructions
data	funds	premises
earnings	goods	wages

The **contents** of the letter **were** very surprising.

Irregular plural forms

Some count nouns, especially those derived from Greek, have irregular plural forms:

SINGULAR	PLURAL	SINGULAR	PLURAL
medium	media	radius	radii
datum (rare!)	*data	stimulus	stimuli
symposium	symposia/ symposiums		
analysis	analyses	criterion	criteria
axis	axes	phenomenon	phenomena
basis	bases	antenna	antennae / antennas
crisis	crises	formula	formulae / formulas
emphasis	emphases	appendix	appendices /appendixes
hypothesis	hypotheses	index	indices /indexes
parenthesis	parentheses	matrix	matrices /matrixes
thesis (diplomityö)	theses		

Plural-looking

Some count nouns that appear to be plural in form can actually be used in both a singular and plural meaning:

Singular meaning:

- **A means were/was** found to move the bookcase without having to take it apart.
- **A** new **species** of mosquito **have/ has** recently been found in Southern Finland
- **A series** of experiments **was / were** used to prove Einstein's theory of relativity.

Plural meaning:

- In 1900, the main **means** of transportation **were** the horse, train, ship, or your own feet.
- There **are** over 150 **species** of mosquitoes in Finland.
- Several good British **series are** on television at the moment. (plural)

Mass nouns

Mass nouns typically refer to **liquids** (water, juice), **powders** (sugar, sand), or **substances** (metal, wood) that lack clear boundaries or form.

Aggregate nouns

Aggregate nouns refer to a group of similar people or objects. Although these nouns appear to be singular, they are not. Aggregate nouns have no plural forms, even though they are normally used with **plural verb forms**. Note that the nouns marked with an asterisk cannot be used with *a* or *an*

*staff	spacecraft	government
*personnel	aircraft	parliament
*management	audience	committee
*police		board

The **staff** is very polite and helpful. (the staff seen as a group) The Helsinki **police is** investigating another murder. (the whole department)

The **staff are** very polite and helpful. (the staff seen as individuals) Helsinki **police are** dissatisfied with their salaries. (individuals within the department)

Collective nouns

Like aggregate nouns, collective nouns refer to a collection of similar objects and have no plural forms. However, they differ from aggregate nouns in that they require a **singular verb**:

software	machinery	landscape	plumbing
hardware	equipment	scenery	wiring
code	circuitry	information	*data

- The **software is** currently under development. The **equipment is** working exactly as promised.

*Beware! The noun data is actually plural but is increasingly being used by scientists as a collective

uncount noun:

- The **data was / were** analysed using SPSS statistical analysis software.

Plural uncount nouns

Many nouns describing fields of **science** or other human **activities** are written in the *plural form* but are used with a **singular verb**:

mathematics	economics	thermodynamics	politics
physics	acoustics	genetics	athletics
electronics	statistics	news	sports

Counters

Although you cannot convert an uncount noun into a countable one, it is possible to add certain phrases to the noun that are countable. We call these phrases *counters*. Counters are used in phrases with the preposition *of* to make an uncount noun countable.

cup	piece	unit	type	form
litre	kilogram	item	amount	body

- Generally, a tyre will lose up to **one or two kilopascals of** air pressure per month in cool weather.
- Some **forms of** energy are more convenient than others in certain situations.

Often in English, many counters can only be used with a particular object or concept. To find a suitable, it might be best to google the word.

- He broke **three panes of** glass.
- He asked for **two sheets of** paper.

However, not all counters come before the noun. In science, counters more often come after the noun as the head noun in a **noun compound**:

- Many software **packages** are available for creating your own graphics.

In science and technology, many nouns can be **uncount** when they refer to a general concept, but countable when they refer to **a type of, one instance of, or an amount of** the same concept:

- The most common meaning given to an uncount noun is a *a type of*:
- Technology is the process by which humans modify nature to meet their needs and wants. (uncount)
- Several **technologies** [types of technology] have been developed to solve this problem. (countable)

Especially, uncount nouns expressing **actions** or **process**, usually formed from a verb, can become countable when they refer to **one instance** or an **embodiment** of that action:

- **Analysis** of the data shows that most Finns are satisfied with their lives. (abstract uncount)
- Section 3 presents **an analysis** [instance of analysis] of the data. (countable)
- Can you give me some **light**; I can't see anything in this darkness. (mass uncount)
- The **lights** [embodiments of light] in the kitchen are not working. (countable embodiment)

Other uncount nouns (e.g., velocity, pressure, force, and energy) can become countable when they refer to **an amount of** of that concept:

- The instrument used for measuring **resistance** is the ohmmeter. (mass uncount)
- A 60-watt bulb has **a** higher **resistance** [amount of resistance] than a 120-watt bulb. (countable)

Introducing something 'new'

The indefinite article signals to your reader that the concept expressed by a singular, count noun is new and has not been mentioned earlier. The correct position for new information is after the verb. However, when you are unable to follow this rule, then at least make sure that you signal this with **a** or **an.**

This study **PROPOSES** a novel control algorithm to reduce the interactions described above.

NEW INFO

A novel control algorithm IS PROPOSED to reduce the interactions described above.

NEW TOPIC

Generic *a* and *an*

Use the indefinite article when you don't want to refer to a specific person or thing, but instead to any person or thing of that particular type.

- Anna cannot afford **a car** at the moment. (She knows that they're all too expensive)
- Jukka is searching for **a job** in civil engineering. (Any job will be ok!)

In science and technology, the generic indefinite article is most commonly used for creating definitions, in which both the term and the class are expressed in a generic form:

TERM	=	CLASS	+	DEFINING CHARACTERISTICS
An MP3 player	is	**a** device	**that**	uses the MP3 compression algorithm to store music on a hard drive or flash memory chip for later playback.
A solenoid	is	**a** coil	**which**	converts electrical energy into magnetic energy capable of performing mechanical functions.

- **A number of techniques** can be used for creating artificial visual scenes in computer graphics. It is not unusual for heavy smokers to smoke **a pack of cigarettes** per day.
- We discovered **an important piece of** information.

Presenting amounts and values (a/an)

In science and engineering, the indefinite article and of are also combined to specify an amount or value:

Pattern 1: A(n) [VARIABLE] of [amount**]**

- The **DENSITY** of water **is** 1 gram per cubic centimeter. (text is about 'density')
- Water has **a DENSITY of** 1 gram per cubic centimeter. (text is about 'water')

Pattern 2: A(n) [object] of [VARIABLE] + [amount**]**

- In the men's Olympic hammer throw, **a steel ball of RADIUS** 6.1 cm is swung on the end of **a wire of LENGTH** 1.22 m.

Specific uses of the definite article *the*

The **definite article *the*** is used to indicate two different perspectives. If you are referring to a whole class of something, we call this **generic reference**. However, if you are referring to a specific person or thing, then you are giving the concept a **specific reference**. Unlike, the indefinite articles *a* and *an*, the definite article can be used with any type of noun: count, uncount, singular or plural.

Generic reference:

- **The Finn** is an honest, diligent and reliable worker (singular count noun)
- **The Finns** enjoy a high standard of livings but pay high taxes for it (plural count noun)
- The cost of producing **electricity** has risen dramatically in recent years (uncount noun)
- **The Finn** from TKK gave an excellent conference presentation (singular count noun)
- Biomass accounts for about 1% of **the electricity** generated in the USA (uncount noun)

Many students make the mistake of over-estimating their reader's knowledge. As a general rule of thumb, use *the* when you think your listener will be able to identify the thing that you are referring to, regardless of whether or not you have explicitly referred to it earlier. Thus, by using *the*, you imply to your readers that they should already be aware that such a thing exists. If you doubt that they have this knowledge, use **a** or **an** when referring to one thing that is countable.

Special adjectives (the)

Superlative adjectives

Superlative adjectives make the noun that they modify unique, since there can only be one *tallest building*, *one most expensive car*, or one best of anything:

The **largest** values	The **least effective** method
The **highest** bandwidth	The **most important** solution
The **weakest** signal	The **simplest** formula

Restrictive adjectives (the)

exact	actual	sole	current	above
main	same	only	present	below

- All of **the above reasoning** about scaling only applies to objects that are of the same shape.

Time periods *(the)*

Use the definite article *the* when the noun refers to a specific period in time. Such nouns include time **orientation** the past, the present, the future, as well as those representing specific time periods, e.g., **decades** (the 1990s), **centuries** (the 21st century), **seasons** (the autumn/ winter/ spring/summer), and **time of day** (the morning/ afternoon/ evening).

- In **the 1920s**, Edwin Hubble began studying Doppler shifts in the light emitted by galaxies.

Institutions and titles (the)

- Common institutions usually require a definite article to signal their uniqueness.
- **The E.U.** has passed numerous directives this year.
- Recently, China opened direct talks with **the Dalai Lama**.
- **The Rector** will resign when Aalto University is launched in 2009.

Proper names derived from a common noun (the)

Named products, processes, models, institutions and places are often unique, especially if the second part of the name is something common to our existence, such as river, ocean, forest, and mountains. Notice how in the examples below, the last word in each expression is a common noun (in bold):

The Pacific **Ocean**	**The** European **Union**
The Vantaanjoki **River**	**The** Java collections **framework**
The Baltic **Sea**	**The** Document Object **Model**
The Sahara **Desert**	**The** Sony **Corporation**
The automotive **industry**	**The** European Space **Agency**
The Physics **Department**	**The** North Karelia **Project**

Previous mention

If you are mentioning a thing or concept for the second time, signal this by using the definite article *the*.

- If you have **a cell phone,** which does not have a built-in modem, you will need to purchase a PC card modem for your laptop. **The cell phone** will also need to have a data port.

When you are referring back to something, you do not have to repeat the same noun or use a pronoun (e.g., it, this, they, them). Instead, you can use either ***the*** or ***this*** and a **superordinate** of that noun. In fact, this is more commonly used than *the* for referring back in academic and technical texts.

A hydrogen fuel cell is a device that generates electricity as a byproduct of **a chemical reaction** between Hydrogen and Oxygen. The only other byproducts of **this process** are water and heat, thus producing very environmentally friendly energy without the need for combustion.

However, if the noun that comes before the preposition *of* is either a plural count noun or an uncount noun expressing an action or process, there is a strong tendency in formal writing to omit the definite article.

Plural count nouns:

Precise **measurements of** the energy released in the radioactive decay of a given type of atom showed inconsistent results.

Generations of inventors have tried to create a machine, called a perpetual motion machine,that would run forever without fuel.

Uncount noun:

The same temperature must be maintained throughout the fuel cell in order to prevent **destruction of** the cell through thermal loading. (to destroy..... destruction)

- **Loss of** helium pressure in this cavity results in an automatic engine shutdown. (to lose.....loss)

Right: The lake has **a depth of** 12 metres.

Wrong: The **depth** of the lake **is** 12 metres.

Postmodification by relative clause *that*

A second way to make a noun unique is to modify the noun with a relative clause. This provides extra description to narrow down the meaning of the noun to only one *type*.

- **THE GENERATORS THAT the electric company uses to produce energy** are much more efficient than those in a car engine.

Although the fuel cell itself only emits heat and water as waste, pollution is often caused when generating **THE ELECTRICITY THAT** was required to produce the hydrogen.

However similar to postmodification by the descriptive of, the definite article the can be omitted when the noun is either a **plural count noun** or an **uncount noun** expressing an **action** or process:

- **Solar lights that** charge during the day and light up at dusk are a common sight along walkways.
- In the 1920s, there were **experiments that** suggested energy was not conserved in radioactive processes.

In science and technology, using the **plural form** with **no article** is the most common strategy for talking in a general way about a concept.

- **Many computer applications** show percent-done progress indicators for operations taking more than about 10 seconds.
- **Computer users** are often too easily tricked into giving away personal information in emails or fake web sites.

When talking in a general way about an abstract uncount concept, use the zero article.

- **Electricity** can be generated from heat through the use of thermoelectric generators.
- **Failure** refers to the state or condition of not meeting a desirable or intended objective.
- **Genetic engineering** refers to an experimental technique through which genes can be isolated in a laboratory, manipulated, and then inserted stably into another organism.

the + singular count noun

Use *the* when referring to an entire class of people or **type of inanimate object**, most commonly **devices** and **machinery**.

- When **the user** moves the mouse over an image/text or button, it either fades in or out.
- **The mobile phone** is an indispensable part of the everyday life of Finns.

Chapter Eight. Sentence Structure

- Grammar is not simply a set of rules for making correct sentences, but a tool to express meaning.

A) I went home and ate a sandwich.

B) I ate a sandwich and went home.

C) I like kimbap, mandu, ramen, or kimchi.

D) I like kimbap, mandu, or ramen, and kimchi.

❖ **What is a sentence?**

There are four basic types of sentences:

1. Declarative (common) statements: I am going to the lab.

2. Questions: Are you hungry?

3. Orders (imperative): Finish the experiment today.

4. Interjections: Oh, no! (Someone forgot to go to the bank).

- Don't use imperative forms in the methods section of your paper. It makes it seem like a cooking recipe. Generally, use the passive.

EXAMPLE

X: Add the compound to the mix.

O: The compound was added to the mix.

❖ **What is the difference between a main clause and a subordinate clause?**

There are two types of clause: main clause (also called an independent clause) and subordinate clause (also called a dependent clause).

A main clause contains a subject and a verb that has a tense that expresses a complete thought. It can make sense as a sentence by itself as the underlined clause shows below.

Ex: Although the method improved accuracy, it caused a significant increase in computation time.

A subordinate clause begins with a **subordinator** such as *when*, *although*, *if*, *that*, or *who*. A dependent clause does not express a complete thought and does not make sense as a complete sentence by itself. It supports the main idea in the main clause.

A subordinate clause is formed with **subordinator + subject + verb.** It supports the main clause

EXAMPLE

X: The proposed method was rejected. Because it was not cost-effective.

O: The proposed method was rejected, because it was not cost-effective.

The sentence does not make sense by itself, so it is not really a sentence but only a subordinate clause.

- A phrase is just a group of words that does not have a subject AND verb; for example, "in the morning", "at 10am", "To improve writing skills" etc.

The type of sentence that is commonly used in research writing is the declarative sentence, which makes a statement. There are four kinds of declarative sentences in English.

- **Simple sentence:** A simple sentence has **one independent clause**.

Ex: I like pizza.

- **A compound sentence** has **two main (independent) clauses** joined by a

A) coordinator

B) conjunctive adverb or a

C) semicolon

A) **Coordinator (**for, and, nor, but, or, yet, so)

Ex: I really like bulgogi**, but** she prefers pizza.

B) **conjunctive adverb** (accordingly, consequently, for example, furthermore, hence, however, in addition, in contrast, in fact, indeed, instead, moreover, nevertheless, otherwise, therefore, thus)

Ex: Writing well is a difficult skill to develop**; however,** it is important for professional success.

C) Semicolon

Developing writing skills is a challenge**;** It takes a lot of time and effort.

- **Complex sentence:** A complex sentence has **one independent and one (or more) dependent clauses**. There are three kinds of subordinate clauses:

A) adverb clause

B) adjective clause and

C) noun clause

A:

In an adverb clause, the subordinate clause can be either in the beginning or end of the sentence. Words like *while, when, if, because, since, whereas, as*, etc. introduce subordinate adverb clauses. The punctuation depends on the placing of the dependent clause(s).

Ex: Because using multimedia is more interesting to students, they may be more motivated to learn.

Ex: They may be more motivated to learn because using multimedia is more interesting to students.

B) Adjective (relative) clause

Ex: Communicative teaching is done using group work, which helps students to have more time to use the new language in conversation.

C) Noun clause

Ex: The teachers do not agree that the teaching method is effective.

- **Compound-complex sentence**

A compound-complex sentence is a combination structure that has two main clauses and one (or more) subordinate clauses.

Ex: Because effective writing and communication skills are difficult to develop, companies value employees who have these skills, so they are more likely to achieve promotion.

❖ **What is a phrase?**

A phrase is simply a group of words without a subject and verb but functioning as a grammatical unit in a sentence.

1) Verb phrase: A verb phrase acts as the verb.

Ex: Most of the conference participants will be arriving early in the morning.

2) Prepositional phrase

A prepositional phrase can be an adjective modifier giving more information about the noun itself or an adverbial modifier giving more information about the time, place, or circumstances.

Ex1: Most **of the conference participants** will be arriving early in the morning. (adjective modifier)

Ex2: Most of the conference participants will be arriving early **in the morning.** (adverbial modifier)

3) Noun phrase

Ex: Most of the conference participants will be arriving early in the morning.

4) Gerund phrase

A gerund phrase can function as a subject or as a direct object.

Ex1: Seeing is believing. (subject)

She tried **bungee jumping.** (direct object)

5) **Participial phrase:** A participial phrase can modify a subject or a direct object.

Ex: Trusting her instincts, Jin-ah tried a new approach to the experiment. (subject modifier)

Ex2: I am reading an article **discussing human synthetic muscle**. (direct object modifier)

6) Infinitive phrase

An infinitive phrase can function as a direct object (noun); as a subject (noun); as an adjective; or as an adverb.

Ex1: This research group wants **to improve fuel efficiency**. (direct object)

Ex2: To improve the accuracy of the results may be very difficult. (subject)

Ex3: The government's plan **to increase spending on research** is vital for the economy. (adjective)

Ex4: They arranged the agenda **to concentrate on the problems in the organization**. (adverb)

The next important principle is that clauses must be joined logically. The most common problem is overusing "and" to join clauses. The word "and" should only be used to join clauses that have the logic of "addition."

Ex: The method improves accuracy and requires a longer time to compute.

This sentence seems strange. This is because the two parts are joined with "and", but the relationship between them does not show the logic of addition. One clause is positive, but the other is negative. Therefore, the connecting logic should be contrast, not addition.

- How clauses are joined together in sentences, and how sentences are joined together in paragraphs should have a clear logical structure.

The essential logic of sentence structure is formed around the following meanings: To illustrate this point, let's look at some simple sentence examples. The three sentences below all make

grammatical sense, so which one is correct? Clearly it depends on the context and purpose of the sentence.

EXAMPLES

1. I went home, so I watched the game on TV.

2. I went home, and I watched the game on TV.

3. I went home, but I watched the game on TV.

- **Connecting clauses**

There are two different ways that we can join clauses into sentences:

1. Coordination and

2. Subordination

Coordination is used for two clauses that co-operate or that are grammatically equal. Subordination is used when one clause gives additional information about the main clause or depends on the main clause for its meaning. The clauses are not equal grammatically. Therefore, follow these general principles.

1) If you have two equal ideas, join them using coordination.

2) If you have two unequal ideas, join them with subordination.

Coordination structures

A **compound sentence** has two independent clauses joined by *and, but, for, nor, or, so, yet.*

Ex: The conventional method is unreliable, and the maintenance costs are too high.

Semicolon

- The material is very susceptible to contamination**;** it requires pure hydrogen and oxygen.

Ex: The high temperature makes reliability a problem; however, it has a number of advantages.

accordingly, consequently, for example, furthermore, hence, ; however, in addition, in contrast, in fact, indeed, instead, moreover, nevertheless, on the other hand, otherwise, then, therefore, thus

- Do not use "So," in the beginning of a sentence in research writing. The purpose of a coordinator is to join two main clauses. The word "So," at the beginning of a sentence may be used in casual writing and dialogue, but not in engineering writing.
- Avoid using "But" at the beginning of a sentence in engineering writing. It is a more casual expression. Use "However," instead.
- Each sentence should have one main idea. Using AND as a coordinator twice may make a sentence too long and the relationship between the ideas may start to become unclear. Don't use AND twice in a sentence to join main clauses.

Ex1: The proposed method is faster and more accurate than the conventional method.

Ex2: The proposed method is not only faster, but also more accurate than the conventional method.

Ex3: This almost perfect growth of each individual pore is a consequence not only of the lithographic pattern but also of the orientation of the silicon single crystal.

Ex4: The experiment was a disaster, so we had to start again.

Ex5: The experiment was a disaster; therefore, we had to start again.

Ex6: The experiment was a disaster; we had to start again.

Semi-colon; vs. colon:

Ex: They can be divided into three main approaches: frequency, spatial, and temporal.

5) Lists of choices

Ex1: Do you want coffee, tea, or coke to drink?

Ex2: Do you want coffee, tea, and coke to drink?

6) Sentence structure punctuation errors in coordination

X: We need to design a new system it must be three times faster than the current one.

X: We need to design a new system, it must be three times faster than the current one.

CORRECT: We need to design a new system, but it must be three times faster than the current one.

CORRECT: We need to design a new system; it must be three times faster than the current one.

CORRECT: We need to design a new system; however, it must be three times faster than the current one.

CORRECT: We need to design a new system that must be three times faster than the current one.

CORRECT: We need to design a new system. It must be three times faster than the current one.

Relative clause

A relative clause is a type of subordinate clause that gives more information about a noun or pronoun. There are two types: restrictive and non-restrictive. A non-restrictive (also called non-identifying) relative clause just gives additional information about the subject. A comma is used to indicate that the clause is additional information.

Ex: Based on our simulation results, the estimation error of the model when the subject wears eyeglasses is 8.17%, which is larger than the error obtained from the offline FME algorithm.

Noun clause

A noun clause is a dependant clause that functions as a noun. It can have the role of subject, object, or subject complement.

Ex: The department requires that all students must attend orientation.

- One key to effective writing is having a variety of sentence types and sentence lengths.

- Generally, when writing engineering papers, the average sentence length of a paragraph should be around 24 words. If your average number of words per sentence is above 25, your writing style might be hard to read.

Chapter Nine. Information Ordering

This chapter focuses on three essential principles that will make your writing more reader friendly:

- According to the given-new principle, sentences should begin with something that has already been mentioned, or is otherwise familiar to the reader, before introducing new information. A given-before-new ordering makes it easier for readers to see how each new piece of information fits into what they already know.
- Writers should also aim to create focus in their texts. Creating a focus requires writers to keep two things in mind. Firstly, they need to determine what the text is 'about' by selecting appropriate topics. Secondly, they need to use strategies to keep the text topic 'in the spotlight' as the text develops from sentence to sentence. This we call organising flow.
- The light before heavy principle recommends that verbs should occur fairly soon in English sentences, before any long, complex noun phrases. In this way, the writer can make it easier for readers to process the message.

The given-new principle

Here are two versions of a text. Which do you find easier to understand?

Text A:

The application of science to the creation of useful devices to meet the needs of society is called mechanical engineering. The design, manufacture, operation and maintenance of a wide variety of machinery are the focus of a mechanical engineer's work. Jet engines and minute instruments for use in medicine are amongst the products designed by mechanical engineers. Engineering drawings of the devices which are to be produced are created by mechanical engineers. Manual work was the normal means of creating drawings before the late 20th century, but computer-aided design (CAD) programs have been used to create drawings and designs since the use of computers became widespread. Three-dimensional models can be used directly for manufacturing the devices thanks to modern CAD programs.

Text B:

Mechanical engineering is the application of science to the creation of useful devices to meet the needs of society. Mechanical engineers focus on the design, manufacture, operation and maintenance of a wide variety of machinery. The products of their work range from jet engines to minute instruments for use in medicine. Mechanical engineers usually create engineering drawings of the devices which are to be produced. Before the late 20th century, drawings were usually made manually, but the widespread use of computers has now enabled the creation of drawings and designs using computer-aided design (CAD) programs. Modern CAD programs allow engineers to produce three-dimensional models, which can be used directly in the manufacture of the devices depicted.

Most people prefer text B. Why? Although both texts introduce the same information, the order in which the information is presented is different. Text A is less effective because it is difficult to see what the paragraph is about. Each sentence starts with new information which at first sight does not appear to be related to what has come before. This is why you may have found this version more difficult to understand. In fact, Text A appears to be about seven different topics (in bold below), making it hard to see what point the writer wants to make.

A framework for hanging new information

Text B is more effective because each sentence (apart from the first one) begins with something that has already been mentioned, or is otherwise familiar to the reader (given information). In this text, the new information is placed at the end of the sentence. This given-before-new ordering makes it easier for readers to see how each new piece of information fits into what they already know. Thus, given information provides a context that helps us make sense of what is new.

Text B: Mechanical engineering is the application of science to the creation of useful devices to meet the needs of society. **Mechanical engineers** focus on the design, manufacture, operation, and maintenance of a wide variety of machinery. **The products of their work** range from jet engines

to minute instruments for use in medicine. **Mechanical engineers** usually create engineering drawings of the devices which are to be produced. Earlier, **drawings** were usually made manually, but the widespread use of computers has now enabled the creation of drawings and designs using computer-aided design (CAD) programs. **Modern CAD programs** allow engineers to produce three-dimensional models, which can be used in the manufacture of the devices depicted.

Organizing flow

As we have seen in the module on the given-new principle, it is important to put familiar information at the start of sentences, and save until the end any new ideas, or ideas that we want to bring to the readers' attention. This sequencing of information can give a sense of flow (also often called cohesion) to your writing. However, flow alone is not enough. Your text must also have a sense of unity (coherence), that you are discussing something, not simply introducing or briefly touching on a list of ideas.

In addition to ensuring that the given-new ordering (cohesion) of your information is preserved, it is also important to give your writing a focus (coherence). Look at the example paragraph below.

Good cohesion, but no coherence:

Romance languages descend from a Latin parent, and **many words based on Latin** are found in other modern languages such as English. **English** has become the lingua franca, the learned language of science and trade. **Science** is based on experimentation, description, and categorisation. **Descriptions of the 'northern lights', or Aurora Borealis,** often incude the words 'twinkle' or 'flicker' to explain the movement created when solar ions collide with the Earth's atmosphere.

The paragraph has excellent cohesion of given and new information between sentences, but it still makes no sense, because it seems to 'jump around' from one topic to the next. What is the topic of this paragraph? What is it about? The writer just doesn't seem to be able to 'stick to the point'. The paragraph has no focus, because it completely lacks a single unifying topic.

Topical progression

We have seen that writers need to keep the topic of discussion clearly in focus if they want to create a text, which flows onwards smoothly and logically.

There are four basic patterns that writers can use to create a focus and develop topics in English texts. However, the patterns found in academic writing are rarely as simple as presented in the following page! Normally, texts are a mixture of the four patterns.

Pattern 1: Constant topic

Here, the writer uses the same topic in a series of sentences. Often, the actual word(s) used in the topic of the first sentence may be repeated using identical wording or reduced wording (ceramic ink... ink) in the topic of a later sentence. However, **a synonym or pronoun** (it, they, this, these) may also be used to refer to the same topic.

Pattern 2: Step-wise topic

In this pattern, an element of the comment of the previous sentence becomes the topic of the next. This pattern allows the writer to form bridges between parts of the text, while the message develops in a logical way. This pattern is the second most common of the four.

Pattern 3: Hypertopic

In this pattern, the first sentence introduces a general topic, the **hypertopic**, using a superordinate term. The topics of the following sentences form sub-topics (e.g., car, bicycle, train, bus) of the hypertopic (e.g., vehicle).

Pattern 4: Split topic

In this pattern, two or more elements of the **comment** in the first sentence are picked up as the topics of the following sentences.

The light-before-heavy principle

Writers can help readers to grasp their message more quickly and easily by paying attention to how they order information in their sentences. In general, writers can make their readers' job easier by making sure that the main verb occurs relatively close to the beginning of English sentences. In order to explore these ideas, this unit takes a closer look at the light-before-heavy principle: the convention of starting sentences with a short, simple subject and placing long, complicated concepts after the verb.

- **We have shipped** the Environmental Protection Agency's National Homeland Security Research Center in Cincinnati, Ohio, AN EDS SYSTEM.

In the improved version below, notice how much easier it is to quickly take in the information. Because it places **lighter information** (an EDS system) before **heavy** (the Environmental Protection Agency's National Homeland Security Research Center in Cincinnati): Thus, by the time readers get to the ninth item, they already know the answer to **what was shipped**? as well as a bit about **to whom it was shipped**?

We have shipped AN EDS SYSTEM to the Environmental Protection Agency's National Homeland Security Research Center in Cincinnati, Ohio.

Let's now look at how you can order your phrases to create more balanced, reader-friendly sentences.

EXAMPLE 1: When writers begin sentences with a short noun phrase, this helps to make the sentence relatively easy to read.

Advanced production processes WERE INTRODUCED in 2003.

EXAMPLE 2: When the sentence begins with a longer noun phrase, the reader has to process a greater mental load.

These advanced ferrochromium and stainless steel production processes WERE INTRODUCED in 2003.

EXAMPLE 3: An even more complex noun phrase at the start of the sentence makes the readers' job very tough!

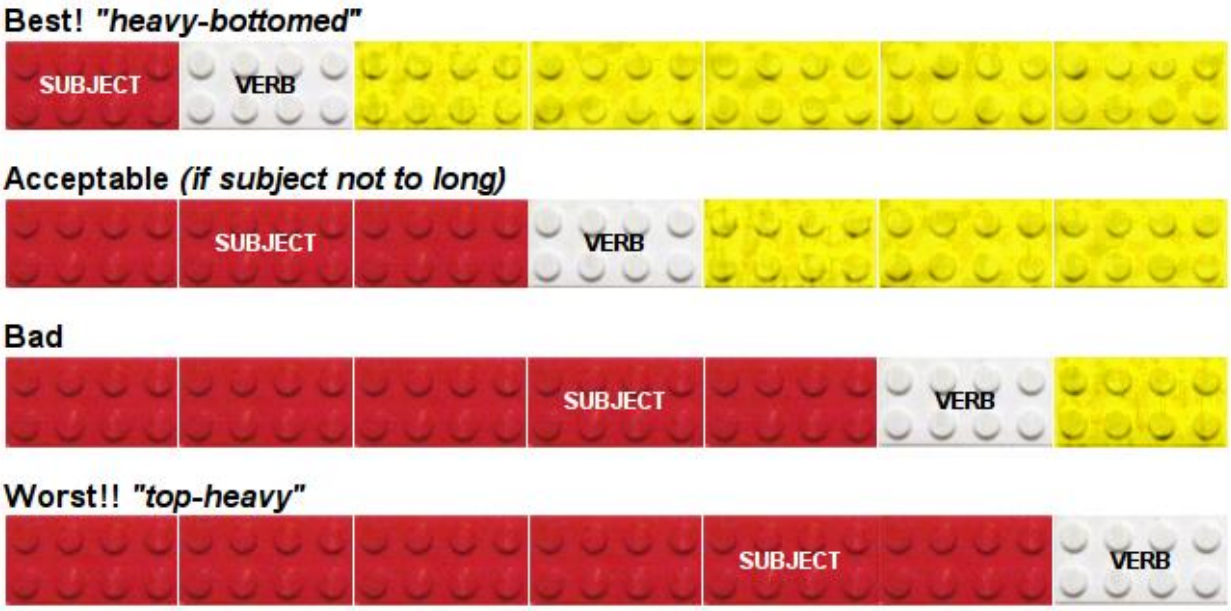
These advanced ferrochromium and stainless steel production processes at the Pyykki Steelworks in Northern Ostrobothnia WERE INTRODUCED in 2003.

EXAMPLE 4: The readers' task is harder still when the prepositional phrase of time is shifted to the start of the sentence! Here, readers have to get through 17 words before they find out what 'happens' when they finally reach the verb.

In 2003, these advanced ferrochromium and stainless steel production processes at the Pyykki Steelworks in Northern Ostrobothnia WERE INTRODUCED.

Balancing Information Elements

English prefers sentences that contain a short subject, come quickly to the verb and then can go as long as needed. However, what is most undesirable are sentences that are top-heavy. In other words, you should avoid overloading your reader by placing heavy elements at the beginning of the sentence. Instead, English prefers heavy-bottomed sentences, those that place most of the information at the end of the sentence after the verb.



Repairing problems

What can writers do to avoid putting heavy elements before light ones?

In this unit, we examine three principles for ordering information at the sentence and paragraph level: given-new, organising flow and light-heavy. You can keep the three principles in mind from the beginning of creating your text.

The following list provides you with eight strategies that can be used to patch up problems once you begin to revise your text. Take a look at each one in turn.

1. Use synonymous repetition

2. Use pronouns (it, they/this these)

3. Use topicalising phrases

4. Use the active-passive shift

5. Use the equative shift

6. Use the animate-inanimate shift

7. Use the personal-impersonal shift

8. Use introductory it (dummy subject)

9. Use existential there (dummy subject)

Identical wording

Because academic writing requires **precision** in the use of terms, it is not surprising that **direct repetition** of the same term is the most common means of keeping the focus on a particular topic. Unlike the use of **pronouns** (it, they, them, this, these), which can easily refer back to more than one item in the text, **repetition ensures** that your reader cannot misinterpret which item you are referring to. However, direct repetition has one drawback. It becomes monotonous and boring if overused. Note how all the examples below require **the definite article the** to signal that this is **given information**.

Catalytic hydrocracking is **a refining process** that uses hydrogen and catalysts at relatively low temperatures and high pressures to produce high-octane gasoline, jet fuel, and/or high-grade fuel oil. **The process** uses one or more catalysts, depending on product output and can handle high sulfur feedstocks without prior desulfurization.

Synonyms

One way to introduce some variation into your text while maintaining topical focus is to use synonyms for your topical information.

The European Mars Express space probe has sent back highly detailed **images** of the surface of the Red Planet. The **pictures**, taken with its High Resolution Stereo Camera, show craters, a volcano and features thought to be created by flowing water.

Superordinate terms

Superordinates are words that describe a class of objects. For example, the superordinate term for bicycle, car, bus, airplane, and train is vehicle, while the superordinate for cat, dog, horse, and tiger could be animal. Superordinates are also important for writing definitions (e.g., The cat is an animal that hunts at night.) and when listing examples (e.g., Cats, dogs, and other animals)

The Mars Exploration ROVERS are six-wheeled robotic vehicles that will be used to explore the surface of Mars. **The ROVERS**, powered by solar panels, are robotic 'field geologists' that will examine Martian rocks and soil for signs of the presence of liquid water in the past of Mars. The top speed of **the VEHICLES**, which are about the size of a golf cart, is five centimeters (2 inches) per second.

Closely-related concepts

Another way to keep your readers' attention on the topic is to **integrate your topic** into closely related terms. In science and technology, this is primarily achieved using three strategies:

1. 'Piling up' nouns to create **noun compounds** (e.g., *carbon dioxide concentrations*)
2. ***of*-genitive** forms (e.g., *concentrations **of** carbon dioxide*)
3. **Postmodification by relative clauses** (e.g., *carbon dioxide **(which has been) created by humans***).

Strategy 2: use pronouns (*it, they/this these*)

Personal pronouns (*it, they*)

The benefits of process control are many. **THEY** include achieving reduced variability and

higher quality, safety enhancement, reduction of process upsets, and in many cases, environmental improvements due to achieving mass balance in processes with material in/product out.

Demonstrative pronouns (*this, these*)

In the 19th century, Poul la Cour discovered that **fast rotating wind turbines with fewer rotor blades generate electricity more efficiently than slow moving wind turbines with many rotor blades**. **THIS** opened the door to **a number of wind turbine advances** during the 20th century. **THESE** included the introduction of AC generators, electromechanical yawing to ensure that the rotor always faces directly into the wind, and stall controls to keep the rotor from turning too fast in very strong winds.

This / these + repetition of given term

The installed capital COST of a wind farm includes planning, equipment purchase, and construction of the facilities. **This COST**, typically measured in $/kW, **has DECREASED** from more than $2,500/kW in the early 1980s to less than $1,000/kW for wind farms in the U.S

This / these + superordinate term

With the Kyoto Protocol, commitments were made not to actions but to results that were to be measured after a decade or more. **This APPROACH** has several disadvantages. An obvious one is that it is difficult to determine, until close to the target date, which nations are on course to meet their goals.

Strategy 3: use topicalising phrases

A topicalising phrase is an introductory prepositional phrase placed in **topic position** (at the start of a sentence), which links what is to follow with what has already been mentioned.

FIRST-AID for: **given-new** and **organizing flow**

Finland has spent a considerable amount of money on cleaning the Baltic Sea. **Despite these efforts,** the beaches along the southern coast of Finland are still plagued by blue algae every summer.

Here are some examples of frequently used topicalising phrases, which can be adapted for use in different text contexts:

COMPARISON-CONTRAST

- Similar to [GIVEN], . . .
- Unlike [GIVEN], . . .

MEANS

- Using these methods, . . .
- With this framework, we . . .

TIME

- After the solution was treated, . . .
- Before analysing samples, . . .

PURPOSE

- To solve this problem, . . .
- In order to analyse this problem, . . .

LOGICAL CONNECTION

- Because of this problem [GIVEN], . . .
- Despite this problem [GIVEN], . . .
- In addition to [GIVEN], . . .

Strategy 4: use the active-passive shift

FIRST-AID for: **given-new** and **organising flow**

Fennotek supplied the prefabricated timber units.

The prefabricated timber units were supplied by **Fennotek.**

Strategy 5: use the equative shift

FIRST-AID for: **given-new, organising flow,** and **light-heavy**

The difficulty is the large particle size.

The large particle size is **the difficulty**.

Strategy 6: use the animate-inanimate shift

FIRST-AID for: **organising flow** and **light-heavy**

In this paper, systems that use speech recognition are described.

This paper describes systems that use speech recognition.

Other subject-verb combinations of this type include:

• **This paper** presents . . .

• **Figure 2** illustrates . . .

• **These graphs** show . . .

• **This section** addresses . . .

• **The latest studies** focus on . . .

Strategy 7: the personal-impersonal shift

FIRST-AID for: **given-new**, **organising flow,** and **light-heavy**

- **The application of conventional controls** IS DISCUSSED for flow, level, and pressure in the distillation columns.
- WE DISCUSS **the application of conventional controls** for flow, level, and pressure in the distillation columns.

Strategy 8: use introductory it (dummy subject)

FIRST-AID for: **light-heavy**

- **CREATING** interfaces between humans and technology that feel natural and include the entire set of sensory interactions would be **difficult**.
- **IT** would be **difficult TO CREATE** interfaces between humans and technology that feel natural and include the entire set of sensory interactions.

Strategy 9: means-purpose shift

FIRST-AID for: **light-heavy**

- The humidity ratio was determined **(by) using** Equation 8.
- Equation 8 **was used** to determine the humidity ratio.

Below you will find a list of words expressing **means** (Finn. keinot).

on	by using	through	through the use of
By	using	by means of	with the aid/help of
With	via	by the use of	with the use of

Chapter Ten. Paragraph Structure 1

A sentence in English is the basic unit of grammar and thought. However, the paragraph is the basic unit to organize that thinking. If a student asks me if a sentence is correct, I usually ask them for the context of where that sentence came from. In short, without paragraphs, there is only grammar, not really writing. The sentences before and after a sentence can affect the meaning of the sentence and how a reader understands that sentence.

In research and professional writing, we don't communicate in sentences, but in paragraphs. Even email should not be written sentence by sentence with no paragraph organization. When you write a formal email, for example, you should organize your sentences into paragraphs. There are four essential concepts that should be understood about paragraphs.

• Generally have one clear main idea per paragraph in the form of a topic sentence.

• Understand the structure of the paragraph.

• Understand the method of development of the paragraph.

• Show how the ideas are related to other ideas, sentences, or sections of your work.

Topic sentence: The topic sentence gives the main point of the paragraph that must be explained, defined, proven, or analyzed. It is almost always at the beginning of the paragraph. What is a good topic sentence? It introduces a proposition that must be argued, explained, or analyzed. When we read a topic sentence we are introduced to the main idea of a paragraph. However, the topic sentence is more likely to occur in paragraphs that argue, explain, or analyze a point. Each paragraph, no matter how long, should only have one main point contained in the topic sentence. One way to tell if a sentence is a topic sentence is to see if the rest of the paragraph answers the implied question of the topic sentence.

EXAMPLE

"However, transportation fuels and other chemicals may be derived from coal through liquefaction." **Implied question →How are they derived from liquefaction?** The rest of the paragraph answers this question of how liquefaction occurs.

Elaboration of the topic sentence: The topic sentence may be a very general statement. The elaboration sentence gives more specific details of the structure of the paragraph that follows (Reid, 2000 p. 24).

Supporting sentences: This is the standard type of sentence that develops the topic sentence. All of the sentences in the paragraph should support the topic sentence.

Conclusion: A sentence that summarizes the key points of the paragraph. Suggested if the paragraph is long or difficult, or if many ideas have been introduced.

2) Controlling idea(s)

The controlling idea indicates what the paragraph will say more exactly about the topic. It may be found in the topic sentence itself or in the elaboration of the topic sentence in the next sentence. It limits or controls the topic to a specific aspect of the topic sentence in that paragraph.

EXAMPLE

[**Topic**→] The two methods to convert solid coal into liquid fuel are [**Controlling idea**→] direct liquefaction and [**Controlling idea**→] indirect liquefaction.

In our example, the paragraph is about converting solid coal into liquid fuel. To make this topic suitable for one paragraph, it has to be limited in some way. This is done by limiting the paragraph to talking about direct and indirect liquefaction, which are the controlling ideas.

Everything in the rest of the paragraph is controlled by these two ideas that help to structure the rest of the paragraph. Without such a structure, a paragraph can be unorganized.

Paragraph methods of development

When we look at a paragraph closely, we should be able to see a clear structure. There are basically four types of paragraph methods of development in English that are often found in engineering papers. These structures only refer to how the sentences in the paragraph are organized. They do not describe the content or logical relationships.

• **Linked chain**: Explanation or analysis. More common in methods and results

• **Repeated topic**: Description, classification and often with narration. More common in introduction and discussion sections

• **Division**: Common in introduction sections.

• **Hybrid**: Combination of any of the above.

Paragraph structure analysis

Sentences in paragraphs tend to be organized from most general to more specific sentences in a paragraph.

EXAMPLE

Also, captions are widely used to depict titles, producers, actors, credits, and sometimes, the context of a story. Furthermore, text and symbols that are presented at specific locations in a video image can be used to identify the TV station and program associated with the video.

Chapter Eleven: Paragraphs

A paragraph can have an introductory sentence, a central section and a concluding sentence, although the structure of paragraphs can be more varied.

- A paragraph should not be longer than 10 lines
- It is usually a good idea to begin a paragraph with a theme sentence or to place the theme sentence prominently. The theme sentence states the purpose or theme of a paragraph.
- It is possible to distinguish between different types of paragraphs in terms of their purpose, for example the introductory paragraph, the explanatory paragraph, the linking paragraph and the concluding paragraph.

 The consecutive sentences of a paragraph, as well as the phrases in a sentence, must be linked to one another. Markers (i.e. words that indicate the direction in which an argument is moving) play a very important role in this regard.

Formal English

Formal English is explicit even for the foreign reader who uses English as a second language. This requires elimination of contractions (I'm, don't) and personal pronouns, which include: first person (e.g., I, we, our, us*):* second person (you, your, yours); and third person (he, her, it, theirs). Technical text is also void of colloquialisms, jargon, and clichés.

- Avoid Ambiguous words and phrases by selecting a clearer alternative. Replace wordy text (despite the fact that) with a concise alternative (because).
- **Action verbs**: Replace verb-preposition combinations with high quality action verbs (go with → accompany, find out → discover, start out → begin).

Coherent Paragraphs

Create paragraphs with a single topic or focus and include supporting details. Each paragraph usually contains around five sentences (although this is not a rule). To improve comprehension, place the key topic at the beginning of a sentence and new information at the end. All of the ideas contained within a paragraph must relate to one central thought. If there are ideas that relate to other foci, construct additional paragraphs.

Sentence Variety

Avoid using phrases with more than three nouns in a row by dividing the phrase into a shorter noun phrase with a relative clause or prepositional phrase, or use hyphens to connect closely related words in the noun string. Compare the first example, which has six nouns in a row, with the rewritten sentence that follows:

- **The nanotechnology enhanced iron foam column contactor removes phosphorus …**
- **The column contactor uses nanotechnology-enhanced iron foam to remove phosphorus …**

Use the following diverse sentence structures to provide variety.

Simple sentence: Includes subject-verb-object, in that order.

- **The laboratory report summarized the results.**

Compound sentence: A subordinate clause appears before the main clause.

- **If you find the answer, it will relieve everyone in the class.**

Complex sentence: Consists of an independent clause followed by an independent clause

- **The final reports were due yesterday, and no one knew who had the original.**

Compound/complex sentence: An independent clause is preceded or followed by a subordinate clause and then a second independent clause.

- **If you find the answer, it will relieve everyone in the class; admiration from all is a nice reward.**

Chapter Twelve. Patterns of Organization

Another way you can ensure a reader-friendly text is to construct your paragraphs and texts using patterns of organization that are familiar to your readers. Most of the writing in Engineering and science can be described in terms of seven organizational patterns:

1. Definition
2. Description
3. Classification-Division
4. Comparison/Contrast
5. Enumeration
6. Situation-Problem-Solution-Evaluation

Definition

Definition uses words to narrow down the meaning of a concept or object by excluding other closely related things of the same class. The short definition (a single sentence or paragraph) is essential to technical writing. For instance, both Mechanism Descriptions and Process Descriptions typically begin with a **sentence definition**. A definition answers the question what is it? Good definitions employ the following structure:

TERM	**=**	**CLASS**	**+**	**DEFINING CHARACTERISTICS**
An object	is	**a** software **bundle**	**THAT**	consists of related variables and methods.
Civil engineering	is	**an** engineering **field**	**WHICH**	deals with the design, construction, and maintenance of the physical and naturally built environment.

An astronaut	is	**a person**	**WHO**	has been trained by a human spaceflight program to command, pilot, or serve as a crew member of a spacecraft.
A university	is	**an institute**	**WHERE IN WHICH**	research and teaching is performed by scientists.

Sentence definitions are usually expanded into *Extended definitions* using the following strategies:

1. Etymology (*What is the origin of its name?*)

2. History (*What is its origin and background?*)

3. Negation (*What does it not mean?*)

4. Operating principles (*How does it work?*)

5. Analysis of parts (*What are its parts?*)

6. Images (*What does it look like?*)

7. Comparison (*Can it be compared to anything familiar?*)

8. Requirements (*What is needed to make it work?*)

9. Applications (*How is it used or applied?*)

Mechanism description

Mechanism descriptions typically include the following information:

1. Definition (*What is it?*)
2. Purpose (*What is its function?*)
3. Appearance (*What does it look like?*)

• Location and mode of attachment

• Dimensions (height, width, weight, length, depth, thickness)

• Materials

• Number/amount

• Colour

• Shape

• Form (*design, pattern, texture*)

4. Function (*How does it work?*)

5. Composition (*What are its main parts?*)

• Identify and describe each part in detail.

• If needed, provide a mechanism description for each of these parts.

At the heart of each Mars Exploration Rover spacecraft is its rover. This is the mobile geological laboratory that will study the landing site and travel to examine selected rocks up close. 3The Mars Exploration Rovers differ in many ways from their only predecessor, Mars Pathfinder's Sojourner rover. 4Sojourner was about 65 centimeters (2 feet) long and weighed 10 kilograms (22 pounds).5Each Mars Exploration Rover is 1.6 meter (5.2 feet) long and weighs 174 kilograms (384 pounds). 6Sojourner traveled a total distance equal to the length of about one football field during its 12 weeks	10On each Mars Exploration Rover, the core structure is made of composite honeycomb material insulated with a high-tech material called aerogel. 11This core body, called the warm electronics box, is topped with a triangular surface called the rover equipment deck. 12The deck is populated with three antennas, a camera mast and a panel of solar cells. 13Additional solar panels are connected by hinges to the edges of the triangle. 14The solar panels fold up to fit inside the lander for the trip to Mars, and deploy to form a total area of 1.3 square meters

of activity on Mars. 7Each Mars Exploration Rover is expected to travel six to 10 times that distance during its three-month prime mission. 8Pathfinder's lander, not Sojourner, housed that mission's main telecommunications, camera and computer functions. 9The Mars Exploration Rovers carry equipment for those functions onboard and do not interact with their landers any further once they roll off.	(14 square feet) of three-layer photovoltaic cells. 15Each layer is of different materials: gallium indium phosphorus, gallium arsenide and germanium. 16The solar array can produce nearly 900 watt-hours of energy per martian day, or sol. 17However, by the end of the 90-sol mission, the energy generating capability is reduced to about 600 watt-hours per sol because of accumulating dust and the change in sea-son. 18The solar array repeatedly recharges two lithium-ion batteries inside the warm electronics box.

In the example mechanism description, notice how the writer first defines what a rover is (sentence 2), and then proceeds to describe the rover in terms of its physical features**: dimensions** (sentence 5), **requirements** (sentence 7), **components** (sentence 9), **materials** (sentence 10), **shape** of core body (sentence 11), **location** and **dimensions** of parts (sentences 12-14), **materials** (sentence 15), and **function** of the solar panels (sentences 16-18).

Process description

A **process description** pattern uses **chronological ordering** to explain a sequence of events over time. Examples of processes include the sequence of events leading to the movement

of a robot's arm, the treatment of sewage, or the landing of the rover on Mars. All of these consist of a series of actions or events that must occur in an expected sequence over time in order to be successful.

Unlike mechanism descriptions (see above), which guide the reader **part-by-part** through the description, a process description proceeds **step by step**. Nevertheless, process descriptions and mechanism descriptions do share much of the same information:

• Definition (What is it?)

• Purpose (What is its function?)

• Location in time (Where and when does it take place?)

• Agent or 'doer' (Who or what performs it?)

• Operating principles (How does it work?)

• What are its main steps?

The language used in process descriptions is characterized by five features:

1. more extensive use of **intransitive** and **active verbs**,

2. the **present tense**,

3. the sentences in the description occur in **chronological order**,

4. **step-wise** topical progression, and

5. signaling of **given and new information** through use of the **definite and indefinite articles**, respectively.

Two other types of writing of process description are **instructions** and **procedures**. Both lead the reader through the step necessary to carry out a task. However, you should write instructions or procedures only if you expect your reader to perform the process you describe.

Keep separate these two concepts: How to do something and How something happens The first calls for instructions or procedure; the second, for a process description.

Example: Instructions

Recording Movies

You can record movies in either the HDV or DVD format. Before recording, follow steps 1-7 in Getting Started (p. 9-17). Movies will be recorded along with stereo sound.

1. Open the shutter of the lens hood.

2. Open the LCD panel and adjust the angle.

3. While pressing the green button, set the power switch to camera. The HDV lamp lights up and your camcorder is set to .recording standby, the default setting.

4. Select the recording format.

5. Press REC START/STOP.

Linear Hydraulic Actuator

1A **hydraulic actuator** is a device which converts hydraulic energy into mechanical force or motion. 2Actuators **may be divided into those with** linear movement (sometimes called rams, cylinders or jacks), **and those with** rotary movement (rotary actuators and motors). 3Linear actuators **may be further sub-divided into those** which apply hydraulic pressure to one side of the piston only (single acting) and are capable of movement only in one direction, **and those** which apply pressure to both sides of the piston (double acting) and are therefore capable of controlled movement in both directions.

4Linear actuators **may also be classified as** single-ended, in which the piston has an extension rod on one end only, or the double-ended type, which have rods on both ends. 5Single-ended actuators are useful in space constrained applications, but unequal areas on each side of the piston results in

asymmetrical flow gain which can complicate the control problem. 6Double-ended actuators have the advantage that they naturally produce equal force and speed in both directions, and for this reason are sometimes called symmetric or synchronizing cylinders.

Source: Wikipedia. Actuators. Available at <http://en.wikipedia.org/wiki/Actuators>

Comparison-contrast

The **Comparison-Contrast (CC)** pattern analyzes two or more things, based on established criteria. This pattern is very useful in technical situations where we are looking at ideal vs. actual results, or calculated vs. measured values. To make the pattern work, the **things must be comparable**, and the **criteria must be valid for both**.

Example: Comparison-contrast

1Compared with other types of fuel cells, the alkaline variety offered the advantage of a high power to weight ratio. 2This was primarily due to intrinsically faster kinetics for oxygen reduction to the hydroxyl anion in an alkaline environment. 3Therefore, alkaline fuel cells were ideal for space applications. 4However, for terrestrial use, the primary disadvantage of these cells is that of carbon dioxide poisoning of the electrolyte. 5Carbon dioxide is not only present in the air but also present in reformate gas, the hydrogen rich gas produced from the reformation of hydrocarbon fuels.

Enumeration

Enumeration is useful when you want to list or state a number of reasons, purposes, causes, benefits, advantages, disadvantages, or other factors that you want to report. Enumeration offers you a more effective alternative to using additive connectors (e.g., In addition, Moreover, Furthermore).

Example: Enumeration

There are a number of good reasons for immigrating to Finland. **First,** everyone speaks English (though they're not very talkative). **Second,** Finland has a superior, free health system (if you don't mind the long lines) and all education is free (and you get what you pay for). In addition, most public transport is free (except if you get caught). **A third** reason **is that** Finns are friendly, outgoing people (when they're intoxicated). Finns also value equality between the sexes (so, no opening of doors for the fairer sex). **Finally,** where else except in Finland can you swim outside during the winter (through a hole in the ice).

Notice how much less effective this text would have been if the writer had simply used **additive connectors** without a topic sentence.

In Finland, everyone speaks English (*though they're not very talkative*). Finland has a superior, free health system (*if you don't mind the long lines*) and all education is free (*and you get what you pay for*). **In addition,** most public transport is free (*except if you get caught*). **Moreover,** Finns are friendly, outgoing people (*when they're intoxicated*). Finns also value equality between the sexes (so, no opening of doors for the fairer sex). **Furthermore,** where else except in Finland can you swim outside during the winter (*through a hole in the ice*).

Engineering could not exist without problems to solve. No pattern is more essential to communicating ideas in engineering than the **problem-solution** pattern.

Present the components of the pattern in this order:

1. **SITUATION**

• What is the current situation?

• What is the relevance of the topic to your readers?

• Why is this topic important or topical? Why should they care?

2. **PROBLEM**

• What problem did you aim to solve?

• Why was it a problem?

• What would be the criteria (requirements) for a good solution?

3. **SOLUTION**

• What solutions have been attempted earlier by other people?

• What is your solution to the problem?

4. **EVALUATION**

• How do we know that yours was a good solution?

The world-wide industrial markets have changed rapidly in the last ten years. 2To compete globally, manufacturers seek methods to produce low-cost, reliable and high quality products with shorter delivery times. 3One response to this has been to build new, innovative assembly systems.	SITUATION Note the use of the present perfect in English to show past as well as present relevance of the topic.
However, most manufacturers have managed this with only varying degrees of success. 5Furthermore, the existing systems tend to provide incomplete and unreliable solutions	PROBLEM Note how a negative evaluation of the present situation is signaled through the use of negative language.
This thesis describes a new approach to building flexible assembly systems enabling the continuous production of varying mixes of products and quick changes in production requirements	SOLUTION The proposed solution is you're thesis!
This proposed solution offers a flexible assembly system that encompasses a series of different operations including assembly, material handling, and storage. 8Furthermore, the new 3D conveyor model as well as the object-oriented software control tools have been success fully implemented and validated using experimental conveyor modules or objects. 9The generic system	EVALUATION Note how a positive evaluation of the writer's solution is signaled through positive language.

architecture created offers an integrated and flexible platform for the development and/or modification of new and/or existing conveyor systems.	

A good topic sentence has four characteristics:

1. The topic sentence is usually (but not always!) the **first sentence** in the paragraph.

2. It makes a **general statement** that is wider in its scope than the rest of the sentences in that paragraph. In other words, the topic sentence should be general enough so that it can be supported by specific details in later sentences.

3. Topic sentences should always contain both a **topic** and a **controlling idea**. The **topic** typically occurs before the verb and is *what the paragraph is about*, while the **controlling idea** is *what you want to say about the topic.*

4. The **controlling idea** should be repeated (preferably, in subject position) in each of the sentences that follow the topic sentence.

Enumeration

In science, topic sentences are often used to introduce a **list of items**. Such paragraphs, based on a **pattern of enumeration**, have topic sentences that typically include **quantifiers**, such as numerous, several, many, much, and a number of.

There are a number of good reasons for immigrating to Finland. **First,** everyone speaks English (though they're not very talkative). **Second,** Finland has a superior, free health system (if you don't mind the long lines) and all education is free (and you get what you pay for). In addition, most public transport is free (except if you get caught). **A third** reason **is that** Finns are friendly, outgoing people (when they're intoxicated). Finns also value equality between the sexes (so, no opening of doors for the fairer sex). **Finally,** where else except in Finland can you swim outside during the winter (through a hole in the ice).

Chapter Thirteen. Article Elements 1

Target Journal

The decision on acceptance is not done based only on the article substance, but the readability of the article also matters. The purpose of the article and defining the research problem must be clearly stated in the introduction, thus giving a justification for the article. This is followed by a literature review, description of the research process and methods, results, and discussion. The beginning and the end of an article **must match** (i.e. the stated problem or research questions must be addressed at the end). Any mismatch will severely diminish your article. The middle part of the article will describe the logic regarding how the results were obtained.

A scientific article must answer the following basic questions:

- What is the problem that is addressed?
- Why is it important?
- How did you study the problem?
- What are your results?
- What are the implications of the results?
- What do you recommend as further study for others?

Article Elements

An article typically constitutes the following sections and elements:

- Title
- Abstract
- Introduction
- Theory/Literature review
- Research method/ process

 Results (sometimes divided into results & analysis)

 Conclusions

There are a lot of writing guides available, which provide advice on the structure of proposed articles. One example is the commonly known IMRAD (Introduction, Method, Results, and Discussion) structure (see e.g., Swales, 1990, Sharp, 2002; Freeman, 2000). The terminology may differ somewhat, as for example in the IMRAD scheme the literature review is integrated into the Introduction section; however, the above list presents the literature review separately. Further, discussion, which D stands for in IMRAD, is the same as conclusions in the above list. Discussion in the above list covers the interpretation of the result by the researcher. This again slightly differs from the IMRAD model. To sum up, there is no commonly accepted right structure and terminology. The differences between journals are, however, marginal, once you have understood the essence of the key elements. The best solution for a researcher is to follow the structure and terminology of their target journal.

- It is beneficial to decide on a target journal during the very early stages of writing an article, rather than first preparing an article and then considering where to send it.
- Analyse potential journals and choose one.
- Write your article with your target journal in mind.
- When selecting your target journal, it is beneficial to conduct an analysis of the purpose and mission of the journal and examine what type of articles they typically publish. Pay special attention on the topics, the structure, and the research methods. Conduct a deeper analysis on about five recent articles in the target journal.

Title

- The title of the report must be considered carefully. A good title is striking and clearly reflects the contents of the report.
- Include important and distinguishing key words; for example, the words that somebody will use in a literature search.
- Leave out any words that are not essential. Avoid meaningless expressions, such as "*A Theoretical and Experimental Study of*…", or longwinded descriptions, such as "*Concise Practical Guide for the Writing of Technical Reports and Papers*". Every word must count.
- When considering a title for your article, do familiarise yourself with the types of titles in the target journal, analyse whether they are more general or very specific.
- Avoid abbreviations in the title as well as unnecessary "and" words.
- The suitable title length depends on whether your target journal favours indicative or informative titles. Journals favouring short indicative titles may, for example, prefer titles with less than eight words. On the other hand, other journals may prefer long informative titles.

Abstract

The Abstract is one of the most central elements of your article, luring other people to read it and may also influence the acceptance of your article. An abstract must describe the purpose of your article. Moreover, it must describe how you have realised your research and provide few key findings and any practical implications. You can build your abstract by answering the following questions with one or two sentences for each one:

- What is the bigger, more general field your article relates to?

- What is the purpose of your article?
- What methodology did you use?
- What are the key results?
- What are the practical implications of your research (how can the results be utilised by e.g. practitioners, society, or companies)?
- Your target journal may have some specific requirements related to formulating the abstract, such as word count.
- The Abstract is typically followed by key words. Follow the practices of your target journal when defining the key words.

Introduction

A good strategy to describe the background is to use the "funnel principle": start by describing the broad background ("big picture") and gradually move to the more specific context of the report. If it is relevant, the introduction will contain a general overview of previous work in the field and definitions of words or expressions that have a specific meaning in the document.

- The purpose of the experiment;
- How the experiment contributes to the objectives of the project/thesis;
- The actual situation that is being simulated in the experiment;
- The physical properties that are being investigated;
- Simplifications made or approaches used with respect to the actual situation;
- Theoretical motivation;

❖ Another approach to stating the objectives is to formulate research questions (i.e. formulate the objectives in terms of questions to be answered).

- ❖ It is very important to explain how the proposed research relates to what other researchers have already done.
- The Introduction justifies the significance of the subject matter and connects your work to previous research.
- It is sensible to write the introduction in a form of a logical *funnel*, where more general aspects are told first and sentence-by-sentence, paragraph-by-paragraph the text should proceed onto narrower detail. The purpose of the article is expressed last in the introduction by describing the research problem.
- The research problem the article aims to address must be described at the end of the introduction. Research questions help the reader to perceive the content of your article and the author to structure his thoughts and writing.
- Utilise published journal articles, preferably recent ones, to point out the importance of your research by highlighting how it relates to them.
- Please note that in most journals the introduction chapter does not include any results.

Literature Review

- The literature review should specifically look for answers to the questions or ways to approach the questions
- It includes how the proposed research differs from published work or what will be repeated for confirmation.
- In reviewing literature, it is very important to integrate the information from different sources, and not to discuss it source by source.

- A good approach is to identify a number of "issues" in literature that relate to the proposed research, and then consider what each source has contributed to each issue.

One can start writing the literature review by finding a few good articles, of which some are from the target journal, and maybe a few good books discussing your topic. Typically, finding one good article relevant to your research starts a chain reaction as some of the references in that article may also be relevant to your work. Write a summary of a few pages based on these articles and books. This will help in obtaining a relevant understanding of your research topic and will act later as a frame for the theoretical part of your article.

- Write the theory to support the storyline of your article. The purpose of a literature review is not to present all possible references, but to concentrate on those that are relevant for the focus of your article.
- The literature review will position your research in relation to previous literature; therefore, cite articles on which your research is based.
- You can reflect your results against the previous literature in the discussion section of your article.
- It is important that you refer to some gurus in your field to show that you know the relevant scientific research.
- It is important to refer to new journal articles to ensure the timeliness of your article.
- Minimise references that are not in English as reviewers cannot verify them.

Methods

Complete specifications for the equipment used include:

 Manufacturer, model no., series no.;

 Settings for the equipment used;

 Calibration certificates with dates and the person or organisation that carried out the calibration.

 Documentation of own calibrations.

- The article must describe your research, the set-up, and research methods precisely.
- In principle, the research method/process should be described so that another researcher can repeat the study.
- It is important to describe clearly how the research is done.
- In addition, you can include more justification as appendices, if necessary (for example, in qualitative research the interview questions). In some fields, it is customary to discuss the reliability and validity of the research in the research method section.

Results

Having completed the experimental research and having analysed the results, it is time to write up and summarise the results as well as the analysis. The experimental section of a journal article must concentrate on the actual *analysis* of the material, not on *documenting* the data.

- While analysing your results, think what the focus of your article will be. If you realise that your results do not match your original idea, be prepared to re-focus. Let your key results define the article focus.
- Consider what the key results of your research are and present them clearly.
- Build the Results section of your article around these key results.
- Regarding the order of presentation, use the funnel principle; from more general to more specific points.

- Remember to highlight the key results by using visual elements, such as lists, illustrations, and tables.
- You may include a Discussion section at the end of your results section to explain and contemplate the results. The discussion can either be a part of the Results section or a separate section of its own, whichever is in line with the practices of your target journal.

The following are general guidelines for tables, figures, and equations:

- The title of the report, figures, and tables should be short, striking, and to the point.
- The titles of tables and figures must be descriptive enough.
- Place the figure or table immediately following the text or paragraph that includes the reference. If this is not practical, place the figure or table on the next page.
- Each table and figure must have both a number and a caption. Figures are numbered as a single series and tables as another.
- Table captions are placed above the table and those for figures are placed below them.
- A capital letter must always be used when a specific table or figure is being referred to, such as Table 2 and Figure 5. The abbreviation "Fig." may be used in the caption of the figure.
- Each column, and sometimes also every row, must have a title, with units if applicable.
- Equations must be numbered sequentially, either 1, 2, …,
- All equations must be indented by at least 10 mm

Conclusions

- The limitations were placed on the work (as a result of external circumstances or through own choice)

- The purpose of this section is to make it clear to what extent the purpose of the report was achieved and which findings were made. Guidelines for the contents are:

 Summarise the purpose of and motivation for the document/project.

 Clarify to what extent the purpose was achieved.

 Discuss the implications of the findings and indicate the contributions made by the report.

 Emphasise the most important findings.

 Provide suggestions for further work, if appropriate.

The Conclusions section, alongside the Abstract and Introduction, is one of the core elements of a journal article. The Conclusions section can be written up by using the following structure (one paragraph each):

 Introduction
 Results (one paragraph for each research question)
 Significance of the research/practical implications, for example for the society, or business companies
 Limitations
 Recommended topics for further study

By using this type of structure, you can make it easier for readers to follow your thinking and enable understanding the core content without reading the entire article. It is important to include the practical implications of your research in the Conclusions chapter; discussing what the implications are for practitioners, companies, etc.

- The Conclusions must be in line with the previous sections and should not present totally new results.

References

- References are cited in the text itself (the so-called in-text references) and at the end in a section called "Reference list" or "Sources used".

When should you give a reference?

 When you quote an author's words directly.

 When you use somebody else's tables, figures, and/or diagrams

 When you put an author's words in your own words (paraphrase)

 When you summarise an author's ideas (summary)

Why should you give references?

 Avoid plagiarism

 Give credibility to your work

 Acknowledge the authors or sources on which you have based your research/arguments

 Help your readers to find the articles, books, or electronic sources that you have used

 Show your reader that you have read extensively on the subject of your text

 Show that your research is up to date

Appendices

- Every appendix must have a descriptive title. The appendices are numbered “Appendix A”, “Appendix B”, etc.

Chapter Fourteen. Article Elements 2

Effective Introduction Sections

Understanding characteristics of research writing in your field

Understand that the purpose of the introduction is not simply to introduce your paper

Introduction is not just about your own paper but its relationship to the field as a whole. The real purpose of an introduction is to persuade the reader of the importance of your paper, and to explain exactly how your paper is making an important contribution to your field as a member of a community of scholars.

Have a clear idea of how your paper is different from other papers

It is a good idea to make it clear to tell the reader (and journal reviewers!) exactly how your paper is different/superior to previous papers. Emphasizing exactly what the new contribution is in your paper's abstract, introduction and conclusion.

Find and follow the author guidelines for the journal or conference

Always read the author guidelines from the journal to which you are sending a paper. The author guidelines may contain very specific information such as the word limits for abstracts, number of keywords allowed, British or American English preferences, preparation of figures, and reference format as well as tools and templates to be used.

Make sure that you are using references properly

It is not acceptable to copy and paste the entire sentence or even much of a sentence from another paper into your introduction. When you use sentences from another paper, you must rewrite the original in your own words.

One of the most common problems students have in writing introduction sections is not clearly explaining the relationship between previous research and the research that is being presented in their own article.

• What is the research problem or area of knowledge that is missing in this field?

• What background does the reader need to know to understand this research problem?

• What have other researchers done to try to solve this problem?

• Why haven't they solved the problem? Or why are their solutions not good enough?

• How is your paper a solution to the problems that other papers could not solve or knowledge that is missing in your field?

• How exactly and under what conditions is your solution better or different than other solutions?

• Even if your solution was not totally successful, what exact knowledge has it contributed to the field and this research problem?

• What other knowledge is lacking concerning this research problem and should be studied in future research?

SITUATION: Explain the background and importance of the topic

A) General background information on the topic may include some very general references to the field.

B) Explain the general research purpose/problem/issue in this field and its importance

C) **Optional**: Define the key terms and/or explain the key concepts necessary to understand the paper.

PROBLEM CYCLE: Review and show problems with previous research, methods, or theories in the field

D) Summarize, classify and compare the different methods, techniques, issues, or theories in this research area.

E) Critically evaluate previous theories/methods/issues including mentioning individual author's articles directly related to the problem of your paper by explaining their strengths and weaknesses.

F) **AND/OR** Indicate a "gap" or data that is lacking in this field to better understand this research problem.

Note: In some papers there may be more than one problem or issue in the research, so they may be a cycle of a summary, analysis, and often criticism which is repeated for more than one issue before the main purpose of the paper is introduced. D+E+F may be mixed together rather than clear separate parts.

SOLUTION: Introduce your paper as a solution to these problems or missing areas of research

Explain how your paper is going to help solve the research problem or fill the "gap" in research in your field that you introduced in STEP 2.

G) Introduce your own paper and how it is going to solve the problem or fill the gap introduced in STEP 2, and give more information about the methodology or arguments used in the paper and how it is different from other papers.

H) **Optional:** Summarize your main results (only in some fields such as some Chemical Engineering papers).

I) **Optional**: indicate the organization of each section of your paper (Common in fields such as computer engineering but not all fields).

Note: Some papers may have a separate section called "Related works" or "Literature Review" especially in the social sciences, where a longer explanation of the background may be found.

Examples of Effective Introduction Sections

Recent work on research writing has revealed that the key to writing better introductions is to understand that a good introduction does not simply introduce your paper. A good introduction persuades your reader how you have contributed to the research in your field—how your research has solved a problem, found missing knowledge, come up with a better method, or invented a new method, algorithm, theory, or idea in your field (Swales, *Research Genres*, 2004). This understanding of research writing introductions helps us understand how to structure the introduction more effectively.

SITUATION: Explain the background and importance of the topic

A) Give general background information on the topic (may include very general background references)

EXAMPLE

"**Currently**, MPEG-2 video [1] is the most common standard for video coding, due mainly to the growth and expansion of digital TV broadcasting all over the world, and it is also popular for storage devices such as DVD. However, there has been a **strong demand in recent years for better picture quality of MPEG-2.**"

OPTIONAL: Define the key terms and/or explain the key concepts necessary to understand the paper.

Research has shown that most writers overestimate the background knowledge of their readers. There are a number of reasons to give more background information in the introduction. Readers can be other graduate students who are not necessarily experts in the field. Other readers may be doing interdisciplinary research, especially in fields such as chemical, materials science, or biomedical engineering.

EXAMPLE

1. “FOF1-ATP synthase is a multisubunit enzyme that catalyzes ATP synthesis in oxidative phosphorylation and photophosphorylation using the electrochemical potential of a proton gradient.
2. **This enzyme consists of two components, FO and F1. The simplest F1 (F1-ATPase) comprises five kinds of subunits** with a stoichiometry of …”

A good introduction should give the background information so that the reader can understand the problem you are investigating in your field.

1. “Many post-processing error concealment methods **have been proposed** (see, e.g., [1], [2], [4], [5], [7]–[10], [12]–[15]). **They can be divided into three main approaches:** frequency, spatial, and temporal. There are also **hybrids of these three main groups**, and the methods can be made adaptive.”

An effective introduction in English is not just a summary of previous research but a critical analysis. This may even include direct criticism of the results of individual articles.

1. “A similar but more elaborated approach is given by **Stander [5]** for detecting moving shadows. **However**, the method is based on a complex geometry model restricted to the detection of cast shadows. **Furthermore, all of the above mentioned classification techniques are based on color edge detection, which is, in general, dependent on the appropriate setting of threshold values to determine the edge maps.** This threshold is found, in general, by trial-and-error. **For general video segmentation and content recognition, manual settings of thresholds should be avoided. Therefore, an automatic way for threshold value selection is required.”**

EXAMPLE

The absolute configuration of incarvilline (3),7 the core compound of these alkaloids 1-3, has been assigned as shown based on Mosher’s method and X-ray analysis of incarvilline methiodide.

However, the absolute stereochemistry of incarvillateine (1) and incarvine C (2) **has still not been established**, …

Although nanotubes are a fundamental form encountered in tilebased DNA self-assembly, the factors governing tube structure **remain poorly understood.**

G) Introduce your paper and how it is going to help solve the research problem or fill the "gap" in research in your field that you introduced in STEP 2.

In short, the review of previous research should directly connect to the purpose of the paper as it does in this example.

2. In an hybrid coder, such as H.264/AVC, **the loss of a frame** can significantly affect the quality of subsequent pictures due to the temporal prediction. **Therefore, it is necessary to introduce some feature to detect the loss of a frame**, to readjust the reference picture buffer for preventing memory access violations and, possibly, to recover the lost image. **In this paper we propose an algorithm based on the optical flow assumptions to conceal the loss of a whole frame.** The method can be executed in real time by an H.264/AVC decoder.

This paper identifies incomplete understanding of a problem because previous research has only focused on rewards for participating in company knowledge management programs rather than understanding the social relationships that influence the use of technology. The authors then focus on the part that is neglected in the research in order to more fully understand the problem.

3. Malhotra and Galletta [13], [24] argued that previous Knowledge management (KM) literature focused on commitment by compliance (to gain extrinsic reward), which makes our **understanding** of social influence and knowledge-sharing behavior **incomplete**. **Thus, this paper investigates several psychological variables** that have been recently introduced into the KM

literature, which enables us to **more fully understand** the important factors and dynamic relationships involved in knowledge sharing in the Technology Mediated Learning environment.

Another effective strategy is to combine two approaches that are not new but have never been used together before. The following example clearly shows the connection between previous research and the purpose of the paper. It shows how previous research has not dealt with the two major research problems in the field simultaneously. This clearly indicates how this paper is different from other papers on the same topic. It also puts emphasis on how the proposed approach in the paper is new by combining approaches in a new way.

G) Give more information about the methodology or arguments used in the paper and how it is different from other papers.

"To address the limitations of the current relevance feedback systems, we put forward a framework that performs relevance feedback on both the images' semantic contents represented by keywords and the low level feature vectors such as color, texture, and shape. Additionally, we have implemented the image retrieval system *iFind* to demonstrate the effectiveness of our approach**. In our opinion, the primary contribution of this paper is that it proposes a framework** in which semantic and low-level feature based relevance feedback can be seamlessly integrated. Moreover, we propose a ranking measure that integrates both semantic- and feature-based similarities for our framework. We also examine possible techniques for automatic and semi-automatic image annotation."

Some fields such as computer and civil engineering often give an outline of the paper at the end of the introduction. However, this is not true in all fields. Check other example journal articles in your field.

"The paper is organized as follows. In Section II, we present our new EC methods, as well as other ones available to our decision tree. In Section III, we discuss the classification tree design and our experiments. Results and conclusions are described in Section IV."

Grammar Guide for Introduction Sections

A) **Present/ Present passive tense:** A process, fact or knowledge that is generally accepted in the field, may or may not be used with references.

B) **Present perfect tense:** (has/have +ed) a summary or generalization about research in the field up to the present or general trends in society. No specific time or date. In citations many studies are usually summarized.

C) **Present continuous/passive tense.** An ongoing situation that is currently developing. More emphasis on the present time than present perfect tense. (… is being developed etc.)

D) **Past tense:** Results of individual experimental papers. Finished events in the past or with a specific time.

"In recent years, technology **has reached** a level where vast amounts of digital information are available at a low price. During the same time, the performance-versus-price ratio of digital storage media **has steadily increased**."

"The strain energy density factor (SEDF) approach **has been used** to analyze fatigue crack growth behavior of welded joints [10–12]."

"However at initial stage of fatigue life a corner crack occurs in lugs, which is the three-dimensional crack of a finite body, therefore the studies mentioned above **have been extremely limited**."

“Many researchers **have addressed** semantic modeling of content in multimedia databases. Researchers **have also reported** on concrete video retrieval applications by high-level semantics in specific contexts such as movies, news, and commercials.

Continuous Tenses +ING forms

Continuous or ING forms of verbs are also used in the first paragraphs to describe a current situation that is still developing.

1. “Performance of traditional approaches to edge-based image segmentation **is being improved** by utilizing advanced segmentation criteria that reflect higher level of knowledge about the segmented object.”

Formal definitions are structured according to the following grammar:

Nanotechnology is a field of science whose goal is to control individual atoms and molecules to create computer chips and other devices **that** are thousands of times smaller than current technologies permit.

“The Kirkendall effect normally refers to comparative diffusive migrations among different atomic species in metals and/or alloys under thermally activated conditions.

Some common vocabulary mistakes when writing definitions:

a) ____ is a kind of _____ is not used in formal writing for definitons. Use “a type of.”

b) “A means B” is not the correct form for definitions. It is used for translation between languages such as English to Persian.

c) Do not use “is called” when writing definitions. It is only used to introduce a new term or to introduce the name of a new vocabulary word but not to describe it.

Structures for giving examples

- There are three methods: A, B, and C.

- There are a number of methods that are commonly used such as A, B, and C.
- There are a number of methods used including A, B, and C.
- The main methods include A, B, and C.
- The most widely used methods are the following: A, B, and C.**or Introduction Sections**

Negative openings

EXAMPLES

- Surprisingly, there is little evidence that such approaches are more accurate …
- However, no study has combined the methods effectively …
- None of the studies examined the role of ….
- Few studies, however, have examined the effects of …, and none, to our knowledge, have compared …

Understand reporting verbs

Be aware of the type of verbs used to present research. The verb shows the opinion of the writer about the research; it is not just a random choice. Verbs like the following: suggests / considered/ presented / obtained/investigated/ examined / provided / evaluated / proposed / all have slightly different meanings. This is a useful guide to using verbs that introduce research: http://www.utoronto.ca/writing/reporting.html

Methods Sections

Common transitions for methods sections include words such as first, then, also, after, next, finally, while, as soon as, consecutively, simultaneously, and sequentially.

In addition, transition phrases are also used to show relationships between steps in time and space. Here are some common examples.

EXAMPLES

Prior to the deposition of X, …

… before adding the X …

In the next step, we determine …

After X was complete, …

EXAMPLE

Block size plays an important role in any file system. In the experiments presented in Section III, we used a DFS-block size of 1 MB. In order to determine the effect of DFS-block size on the performance, and to justify our choice of default block size, we ran the following experiments.

EXAMPLE STRUCTURES

 In order to determine …

 To estimate/ To measure/ To calculate/ To verify/ To evaluate/ To define/ To obtain/ To model/ To ensure the reliability of/ To check the validity of/

GRAMMAR GUIDE: Active and passive sentence structure

Most textbooks and general writing tips advise writers to avoid using passive sentences and to write actively. However, the use of the passive is common as well as necessary in science writing. The basic passive is formed using [Verb be +ed].

EXAMPLES

 Active sentence: I completed the experiment.

 Passive sentence: The experiment was completed.

Use active sentences using “we” or “our” if you want to emphasize YOUR decisions, YOUR method, or YOUR innovation. For standard procedures, generally use the passive structure.

EXAMPLE

The infill material considered was mainly concrete: several concrete qualities were studied in order to investigate the influence of variation of the elastic modulus of the infill; moreover the C20 lightweight concrete (LWC) and polyurethane (PUR) were considered as alternatives. As these two materials, especially PUR, offer the advantage of low weight we thought it worthy to include them in our analysis. In addition, PUR seems to be drawing the attention of other researchers as a possible hollow sections infill material [22].

These two sentences can have very different meanings in English.

□ The temperature was increased by 50 C.

□ The temperature increased by 50 C.

Methods section checklist

1. I have explained my criteria for choosing any special materials/equipment or unusual methods that differ from commonly accepted procedures. □

2. I use transition signals to show the sequence of steps in my methods section. □

3. I have used active sentence structures to emphasize the choices I have made for my methods if necessary. □

4. I have provided enough information so that another researcher could replicate (do) the same experiment with the same results (this is not as easy to do these days, but it is still a worthwhile goal in science). □

5. I have explained the assumptions made in my model or method if they might be questioned. □

6. I not only describe my procedure, but I explain the reasons for choosing my methods where necessary by using sentences beginning with “To +Verb” or “In order to +Verb.” □

7. I have checked my paper again for any problems with passive sentence structure. □

Describing Data Effectively: Results, Discussion, and Conclusion Sections

The first paragraph of the DISCUSSION may summarize the purpose of the paper or the most significant findings. The framework below can generally be found in all fields where an experimental design is used: Introduction, method, results and discussion. Other types of studies such as case studies or papers from applied fields that make recommendations may not follow this pattern but instead may have a separate CONCLUSION section with an emphasis on numbers 1-2-3-4 with only the most important result of the study mentioned and 8-10 below.

Discussion/conclusion structure examples

Different types of papers in Engineering and other scientific fields have different structures. Some papers may have a results and discussion section clearly labeled while others may have a long conclusion section after describing a new design.

Not all of the eleven functions may be found in every paper. Think of them of the choices available to you. Pick and choose what is important. However, almost all Discussion or Conclusion sections start with a review of the purpose or main results of the paper.

Expected or unexpected result or outcome that is not understood by the researcher

In some papers, especially those related to chemistry or biology, the results may be broken down into sections for each major experiment or result. These cycles follow the overall structure of discussion/conclusion sections.

The following example is from a chemical engineering paper that separates the results and the discussion of the results into separate cycles of data description.

Limitations of the research (limited variables, assumptions, only in simulation, etc.)

Limitations of a study may appear in either the discussion or conclusion section depending on the structure of the article.

Grammar of Discussion/Conclusion sections

These sections are unique to Discussion/Conclusion sections. The grammar point numbers match framework 1 Combined Results and Discussion Sections. The other grammar points are similar to results/discussion paragraph framework.

H. Limitations of a study

Near the end of the discussion section or in the conclusion section of your journal article, you should include a paragraph or two addressing the limitations of your study. This is particularly critical in clinical studies, where not acknowledging limitations could lead clinicians to apply your findings before they have been adequately investigated. Here are some examples adapted from Swales of expressions for limiting claims in the discussion section.

Expressions for limitations of the study:

It should be noted that this study has been **primarily** concerned with . . .

This analysis has **concentrated on** . . .

The findings of this study are **restricted to** . . .

This study has addressed **only** the question of . . .

The **limitations** of this study **are clear** . . .

We would like to point out that **we have not** . . .

Expressions for stating conclusions that should NOT be drawn:

However, the findings **do not imply**

The results of this study **cannot be taken as evidence** for . . .

Unfortunately, we are **unable to determine** from this data . . .

The **lack of** . . . means that we **cannot be certain** . . .

Expressions for very limited studies:

Notwithstanding its limitations, this study does suggest . . .

Despite its preliminary character, the research reported here would seem to indicate . . .

However exploratory, this study may offer some insight into . . .

I. Making Recommendations

- "Should", "must" or "could" are usually used to make recommendations or suggestions for practice or policy in applied fields.
- The magnitude of and period of the sensor signal **could be used to** determine the fluid properties such as viscosity, which influences the drag and hence the motion of the particle.
- Future studies **should be** focused on basic mechanisms, such as effects affecting DDAH function, not only on possible associations between clinical events and plasma ADMA.

Present tense is always used to indicate tables or figures:

• Fig. 8 shows…

• As shown in Figure 2, the effect increases with increasing temperature.

• Use present tense to describe the physical characteristics of the figures or table.

• Present tense is usually used to analyze the data or make conclusions or generalizations beyond the data of the individual experiment.

• Weak verbs such as suggest, appears, seems, are often used. Hedging words like "is likely to be, generally, probably" etc. are often used.

Grammar of Location Sentences

The Figure 3 shows the increase in the level of achievement of students after receiving the treatment.

COMPARE:

- The dashed line indicates the development of the control group, while the solid line shows the improvement in the patients.
- Since there are two lines we need the word "THE" to help indicate which one we are talking about "dashed" or "solid."
- The letter "S" is added to sentences that refer to two different figures:

Figs. 2 and 3 both indicate that the improvement was substantial.

- Insets and multiple images in a single figure are not considered different figures.

Fig. 1(a) and (b) shows images of the case before and after treatment.

Help your reader to interpret the data: Draw attention to surprising or very interesting results

"Sentence initial adverbs like *interestingly, surprisingly, importantly, unfortunately, significantly*" and phrase like, "*Of note*, Note that the …" are also often used by authors to draw attention to interesting results as well as "Indeed, In fact,"

The complexity of the proposed algorithm is **significantly** reduced compared with the conventional methods, regardless of the sequence types, as illustrated in Tables II and III.

Most **importantly,** the out-of-plane permittivity was found to be much lower than the in-plane permittivity. The grain boundaries had a lower permittivity compared with that of grains.

Negative results

Sentences showing poor results often start with an unusual and difficult grammar structure called a Negative opening: **Little/Few/No/None of these…** with NO article (a, the) in front.

A. Qualify your argument. Use quantifiers (almost all, a majority of, most, many, some, few etc.)

B. Use a comparison with a similar group: compared to, in comparison to, in contrast to, etc.

C. **Soften and distance the claim:** "based on the limited data available, in the view of some experts, according to this preliminary study, based on an informal survey, this initial investigation into, this exploratory study, etc. (Swales and freak, 2004)."

Using modals to strengthen or limit a claim or conclusion

- Simulation results show that the internet download time can be significantly improved.
- Our results further suggest that errors tend to occur with greater frequency when …
- Using a different model **would** greatly increase results **if the problem of** A was solved.
- This technique could also be extended to use in mobile applications.
- The proposed method **can be used in** the study of binding characters of dipyridamole on the cell membrane.
- It is worth noticing that the proposed DHS algorithm **can be applied** practically in electric appliances, especially in mobile handset due to its simplicity.
- This proposition is not yet proven and **may need re-evaluation** in light of calculations examining the influence of electronic effects on the geometry of a series of complexes.
- **Would** is used for hypothetical situations (not true) in the future or past or if something happens only under some conditions. It is often used with "IF."

If this is the case, **it would provide an alternative** route for exploring the effects of these covalent linkages on heme function that avoids the inherent experimental complications associated with the mammalian peroxidase enzyme.

Comparison with previous results

A is supported by B

A is not supported by B

A is contrary to the findings of B

(Author A) also reported that …

These findings are similar to A who reported that

EXAMPLE

Our results show that **none of these** fundamental changes in A significantly affects B **supporting the hypothesis put forth by others that …**

Chapter Fifteen. Writing Formal Email

The ability to write email to foreign researchers and companies using a style and tone that is appropriate is an essential professional skill.

- **Introducing yourself at a conference or in email**

EXAMPLES

- Hello, my name is Ali Rahimi. I am a master's student in the Department of Chemical Engineering at Iran University of Science and Technology in Tehran, Iran. I am currently researching hybrid materials.
- Hello, my name is Yunes Asadi. I am a Ph.D. student in the Department of Electronics Engineering at Iran University of Science and Technology in Tehran, Iran. I am currently researching video compression, audio compression, and computer graphics.

❖ I am a master's student/master's candidate/doctoral student/doctoral candidate/Ph.D. student/PhD candidate.

- A Ph.D. candidate is considered to have finished taking courses and is currently researching or writing a dissertation, whereas a Ph.D. student is still taking classes.
- These examples are appropriate for introducing undergraduate students.

EXAMPLES

CORRECT: My name is Reza Asadi, and I am a senior in the Department of Civil Engineering at Iran University of Science and Technology in Tehran, Iran.

CORRECT: I am studying Civil Engineering at Iran University of Science and Technology.

CORRECT: My major is civil engineering. I go to Iran University of Science and Technology.

❖ **Writing a bio statement for a conference or journal**

Some journals and conferences will require you to submit a bio, which is a paragraph about your background and research interests of about 75-100 words. It is written in the third person, meaning that you do not use "I" to describe yourself.

EXAMPLE

Hossein Ahmadi received the B.S. degree in Control and Instrumentation Engineering from Amrkabir University in 2015 and the M.S. degree in EECI from Iran University of Science and Technology. He is currently pursuing the Ph.D. degree at the same university. In 2015, the 3rd TI DSP contest prize was awarded to him. He has been engaged in research and development of control system for flat panel displays and has designed LCD controller for UXGA. His research interests include image processing, VLSI design, 3D display, and flat panel displays.

A bio can include

• where you got your previous degrees and what year you graduated.

• which lab you are part of.

• any prizes or awards you have received such as outstanding student conference paper.

• any professional associations you are a member of such as IEEE.

• any poster or conference papers you have presented and at which conference (usually only for graduate student conferences.)

• any other papers you have published (not as common).

• your research interests.

Common mistakes when writing formal email

- For doctoral degrees, use either periods after both "h" and "D" or no periods at all, not just one period. The modern trend is to write it without periods.

- Do not use “about” or “part” to describe your research.

EXAMPLES

X: I am currently researching about fuel cells.

X: My research part is nanoparticles.

CORRECT: I am currently researching fuel cells.

CORRECT: My research field is nanoparticles.

CORRECT: My area of research is hydrogen storage materials.

- You receive a degree in a subject or from a university, but not a department or a division.

EXAMPLES

X: He has a M.S. in the Department of Materials Science and Engineering.

X: He has a M.S. in the Division of Materials Science and Engineering.

CORRECT: He has a M.S. in Materials Science and Engineering from Iran University of Science and Technology.

CORRECT: He is a master’s student in the Division of Materials Science and Engineering at Iran University of Science and Technology.

- If you are emailing a foreign professor whose name is John Jones, the format is as follows:

EXAMPLE

Correct: Dear Professor Jones:

X: Dear Jones

EXAMPLE

X: Prof. Dr. Dong-guk Lee

Correct: Professor Jones

Correct: Dr. Jones

- The abbreviation Prof. is usually only used with the full name, not with family name only, but this is not a serious mistake. The abbreviation Dr. is used with family name only, except for very formal introductions such as introducing a guest speaker. Writing the word "Doctor" is only used for medical doctors, M.D.
- If you are sending an email to a faculty member then use title and family name only except for the most formal situations.
- Use a colon (:) to introduce information. There is no space before a colon, but one space after it.
- A period can also be used for telephone numbers.
- EXAMPLES
- X: Tel)+82-02-2261-4915
- CORRECT: Tel: +82-02-2261-4915
- CORRECT: Tel. +82-02-2261-4915

Politeness in English email

EXAMPLES

X: The comments were very helpful and we have changed the text as recommended. However, we disagree with one of your comments.

CORRECT: The comments were very helpful, and we have changed the text as recommended except for page two paragraph six, which was not changed because …

EXAMPLES

X: Can you edit my paper? I need it on Friday (too demanding, could be used between a boss and an employee).

X: I expect your answer soon.

CORRECT: Would it be possible for you to edit my paper by Friday? The deadline is next Tuesday.

EXAMPLES

X: Can you check my paper?

CORRECT: I was wondering if you could review my article.

EXAMPLES

X: Please send E-mail to me, I hope with good news.

X: I look forward to your positive reply.

X: I am waiting for your answer soon.

X: I expect that I get help from you.

CORRECT: Thank you for considering my application.

CORRECT: I would really appreciate any advice you could give me.

CORRECT: I look forward to your reply.

CORRECT: If you have any questions or require further information, please do not hesitate to contact me at …

There are four basic steps to increase levels of politeness:

1) Change from imperative to question form

Edit this paper -> Can you edit this paper?

2) Change from question form to modal question form (could, would)

Could you edit this paper please?

3) Add politeness phrase to modal question form

I would really appreciate it if you could review this article this week.

4) Add background, a reason, an excuse, or an explanation to your request.

Your paper entitled, "_____" has been essential for my work on _____. Would it be possible for you to explain the method for _____ on page 23 of your article? How does your proposed algorithm…?

Reacting to Reviewers' Comments

Scientific journal articles undergo a peer-review, which means that they are independently reviewed by two or more experts. These experts make a recommendation to the journal editor on acceptance or rejection.

- Obtaining critical comments is a good thing, which means that you have a chance for publication — this is the **time for work and analysis**! The feedback may initially seem harsh, however, do not get depressed. Be analytical and start working.
- It is important to carefully analyse what the feedback really means.
- Do react swiftly to the given feedback and acknowledge all the criticism.
- Should you wish not to change something, regardless of the critique, do justify this decision in the covering notes.
- Do provide a *point-to-point response* acknowledging all the reviewers' comments indicating all the changes to the article, and justify if you did not change something.