



**İTÜ VAKFI**  
yayınları

# ESSENTIALS OF RESEARCH PAPER WRITING

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# FUNDAMENTALS OF RESEARCH

## Definition of a research paper

Research is the extensive investigation of a particular subject and the examination of the information collected for the purpose of revealing evidence about an area of study. Research not only involves bringing together related pieces of information, but also reading the relevant information carefully and analyzing, interpreting, discovering and drawing conclusions from it. It is the intention of researchers to increase the understanding and awareness of the subject under investigation. With research, an answer to one question leads to more questions, thereby creating opportunities for new research to be done, thus enhancing knowledge.

## Reasons for doing research

There may be various reasons to conduct research. In academic environments, term papers or projects are required for some courses. In addition, most undergraduate programs require the production of a thesis/dissertation for the attainment of the degree. For post graduate degrees, it will also be necessary to write a dissertation. Research is by no means restricted to academic life. Often, research articles are written for publication in scientific journals. In business life, especially for the research and development (R&D) and product development departments, research is an integral part of the progress of business and employees will often be asked to present results in the form of projects.

## Types of research

Obtaining information is crucial for planning and starting any research project. Research can be categorized into two main types depending on the method used to collect data. These two types are generally known as *primary* and *secondary* research. The accumulation of new data, through either qualitative (non-numerical) or quantitative (numerical) methods, that has never appeared in any publication before is referred to as primary research. Original data is collected by various means such as questionnaires, interviews, meetings, surveys and experiments.

This type of research is especially used when the research project addresses an issue that has not been dealt with before, or when not enough research has been conducted on that particular issue. Another reason for the use of primary research would be to target a particular group of people or a specific person. Conducting primary research is valuable in that it reinforces the project work, the data

collected and prepared will therefore be unique, and doing this kind of research will augment critical thinking and add value to the paper.

Secondary research is the gathering and evaluation of data that already exists and that can be found in various publications such as databases, journals, newspapers, online articles, magazines or research reports. The term “secondary”, however, does not imply that the research is less important than primary research. This term only specifies the fact that the subject has already been researched and findings investigated and evaluated by others.

Journal articles often start with the presentation of secondary research in the first phase by analyzing findings and continue in the second phase with the analysis of the results of the primary research. In this book, the focus will be on conducting secondary research by reviewing previous findings on a particular topic from existing literature and synthesizing, evaluating and interpreting the information in the preparation of a research paper.

## **Critical thinking**

Critical thinking involves forming and presenting opinions based on evidence and understanding. It requires the ability to be flexible, to not be fixed to one set of thoughts or opinions, and to constantly challenge ideas by constructing logical arguments against them. It requires observation, analysis and judgment.

Critical thinking is an important part of science. It is not enough for scientists, engineers or researchers to only work on problems or projects that follow already-established rules and limitations. They must be pro-active, constantly curious and willing to change their ideas in the light of new evidence. Science requires a great deal of imagination and willingness to spend time and effort trying to discover new methodologies or new theories to explain the mechanisms of the natural world. It is important for anyone interested in science or scientific methods to continually ask questions.

Naturally, simply asking questions is not enough. There must also be some use of the imagination to offer possible hypotheses which can then be tested in an attempt to find the answers. Using questions and logic to constantly review opinions, hypotheses and theories reduces errors and strengthens arguments. Searching for and using quantifiable and testable data gives authority to theories that unsupported opinions cannot and allows others to check, and possibly improve upon, the original idea.

## Ethics in research

As with all disciplines, when conducting research, certain ethical norms must be adhered to, whether results will be published or not. Some general principles of research ethics can be listed as:

- Honesty
- Accuracy
- Objectivity
- Acknowledgement
- Protection of intellectual property
- Protection of people and animals
- Nondiscrimination

**Honesty:** All information in the paper must be presented honestly. Fabricated, misrepresented or altered information, data or results in research means deception and therefore will be considered a breach of ethical code.

**Accuracy:** Care must be given to the presentation of accurate information that is free of errors. A paper should not be left uncorrected.

**Objectivity:** Interpretations of the analysis of data must be objective rather than subjective for the reliability and validity of the study. Any bias that may occur as a result of a person's emotional values must be avoided. Researchers should remain impartial to the conclusions of the study.

**Acknowledgement:** Credit for information used in the paper from other people's work must be given by writing citations in the text and by providing the relevant reference entries in the references at the end of the paper. Someone else's words or ideas should never be presented as original data. Plagiarism must be avoided. Also, in cases where research is done collaboratively, the names of all the contributors should be included. Those who do not contribute should not be shown as having a role in the production. All contributors are responsible for the entire work, not just for the specific parts they prepare.

**Protection of intellectual property:** For any copyrighted material from published or unpublished sources to be either reprinted or adapted in the paper, it is a requirement to acquire the permission of the original creator of that particular material, whether it is a table, figure or picture.

**Protection of people in research:** For qualitative or quantitative studies, human participation may be necessary. The basic ethical rule concerning the use of human participation in research is to show respect. People should also give consent for their participation in any studies. Moreover, participants

should not be harmed in any way. Risks should be kept as low as reasonably practicable. Finally, the personal information of participants should be kept confidential.

**Protection of animals in research:** Some studies make use of animals while conducting experiments. In such cases, researchers are responsible for making sure that the appropriate care is given to the animals during testing. Ensuring animal welfare is a fundamental issue in research ethics.

**Non-discrimination:** Attention must be paid to the just and correct treatment of people. Statements should be free of any kind of discrimination towards a person based on race, gender, age, disability, social status, education or ethnicity.

## **Research paper writing styles**

A research paper is generally written by following certain writing styles. Different institutions have different styles that they follow. Some well known styles in writing are the APA, MLA, Chicago, Columbia and IEEE. This book will focus on the use of the APA style.

The style most importantly determines the format of the paper together with the way citations and references are given. The following tips are intended as a guide to assist the typing of the paper according to the correct format. APA style citations and referencing rules can be found on pages 38-64.

## **Typing rules in the APA style**

The use of a uniform typeface and font size, along with the correct spacing and punctuation, enhances readability, thereby increasing the value of the paper and reducing the need for editing.

**Font type:** Times New Roman

**Line spacing:** Double

**Font size:** 12 point font

**Spacing between words:** 1 space

**Margins:** 1 inch or 2.5 cm.

**Spacing after punctuation marks:** 1 space

**Alignment:** Left

**Spacing before punctuation marks:** No space

See pages 231-236 for formatting tips.



# **Process of writing a research paper**

This book focuses on the **3 stages** of writing a research paper:

## **1. Research and planning process**

This stage involves:

- a. Deciding on a topic to work on
- b. Finding a variety of sources that contain relevant information on the topic
- c. Reading and evaluating sources
- d. Brainstorming based on information from sources
- e. Deciding the correct approach
- f. Stating a claim
- g. Researching sources and determining support
- h. Constructing a thesis statement
- i. Organizing research findings by making an outline

## **2. Drafting process**

This stage involves:

- a. Taking notes from selected sources in the form of paraphrases, summaries and quotations
- b. Checking that all used information is properly cited
- c. Making inferences, comments, deductions and conclusions related to notes taken from sources
- d. Writing paragraphs combining source information with original opinions
- e. Preparing references for the sources used in the paper
- f. Adapting tables and/or figures from sources, if necessary, and referring to statistical or visual information in the paragraphs

## **3. Revision and finalization process**

This final stage involves:

- a. Revising the draft by making all necessary corrections and improvements
- b. Adding any used tables and/or figures referred to in the paragraphs at the end of the paper
- c. Preparing the final paper for submission; fixing the format by arranging the order of the paper, numbering the pages and preparing a title page
- d. Oral presentation (Thesis defense): When preparing a research paper as part of a course, after the paper is completed, a presentation may be required.

# RESEARCH AND PLANNING PROCESS

## Choosing a topic

Here are some points to consider while deciding on a topic.

- The topic should interest the researcher. Otherwise, the researcher will not be motivated by the research process and the outcome will probably be unsatisfactory.
- The topic should be significant. Do not choose trivial topics. The topic should be selected with a view to the future.
- The topic should be manageable. Topics that are too big (too general) may lose focus. Topics that are too narrow (too specific) are also problematic as it may be difficult to find enough source information.
- A researcher should attempt to bring an original point of view to the topic.

In order to find an appropriate topic, various methods can be used. Interesting faculty courses could be a starting point. Contemporary issues presented in the media and on the Internet could also be a source of inspiration. Sometimes, the “Contents” page of books, journals, magazines or encyclopedias can provide ideas for possible topics, as can seminars, workshops, conferences or expositions.

## Narrowing down a general topic

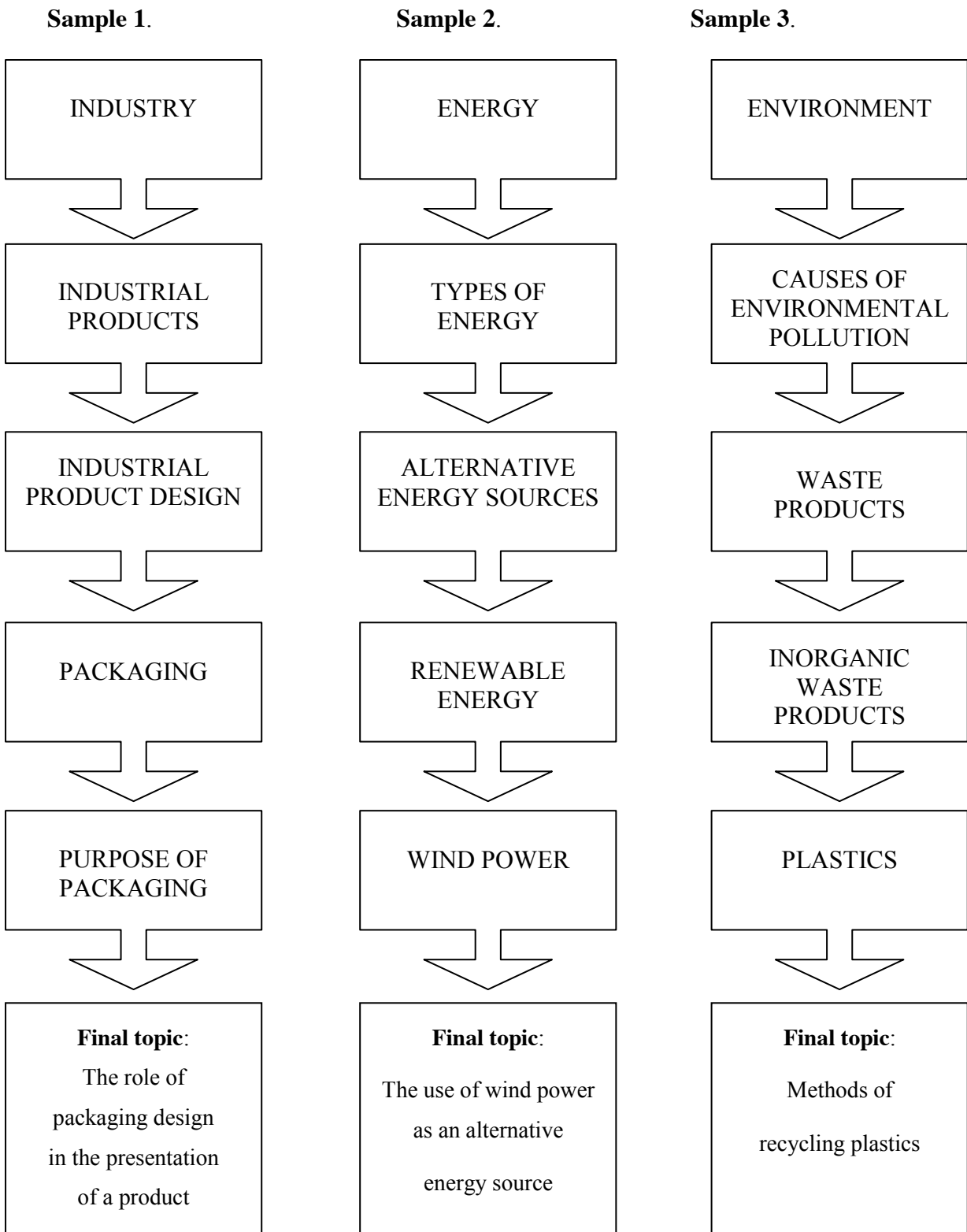
The topic is the subject of the paper to be discussed in detail. After deciding on the topic, there will be a need to focus on a question to explore a particular feature of the topic and draw a conclusion from it.

It is important to ask various questions on the topic and then try to reduce them to one main question that the thesis statement will answer. “What”, “why”, “when”, “how”, “where”, “which” questions can lead to a clear perspective on the topic.

Make sure that the answers to the formulated questions are not self-evident. If most of the information about a topic is already common-knowledge, it is not suitable for research. Questions that require more sophisticated answers will result in more productive papers.

Many initial topics are too broad. It is possible to narrow down a broad topic, working down step by step towards a specific topic that will be suitable for research. The following examples show how to logically use narrowing to arrive at a manageable topic of area.

### Samples for narrowing down a general topic



## Deciding on an approach

The next step to take after deciding on the topic is to choose what the approach to that topic will be. There are 2 main forms of research paper:

1. Papers with a persuasive or argumentative approach
2. Papers with an expository or analytical approach

In **persuasive** research writing, the paper aims to convince the reader of the writer's point of view by presenting various valid reasons as support. In this type of research paper, the writer tries to persuade the readers to agree with a particular attitude, a belief or position regarding the subject matter by using valid, credible and provable information.

An **argumentative** research paper also includes persuasion, but presents evidence in order to support the writer's point of view towards a debatable issue. In this case, the writer takes an overt position regarding the topic. Here, the aim of the researchers is to assure the readers by providing information from sources that supports their point. However, the writer is still responsible for producing a credible argument and must produce convincing and valid evidence.

An **expository** research paper examines a topic from different perspectives by gathering important facts and making critical evaluations. In this case, the writer's position does not have to be explicit as they are not required to favour one particular viewpoint. In this type of research paper, the writer explains the subject matter by separating it into its components, and after thorough research into each component, presents the accumulated data in an organized way so that readers are more informed about the subject.

The **analytical** research paper also aims to explain and evaluate the subject matter objectively. However, all the necessary determinants, constituents, elements, factors and variables should be taken into consideration as this type of research requires a broader perspective. The analytical research paper presents a clear synthesis of all the components involved. As with an expository paper, the writer is not required to favour one viewpoint.

The type of approach researchers take will determine the type of the paper they will write.

## Writing a thesis statement

Once the topic has been selected, a claim must be made to indicate the reason for conducting the research. The paper will focus on this claim and try to verify it. This claim can be developed after an extensive amount of research and brainstorming has been done.

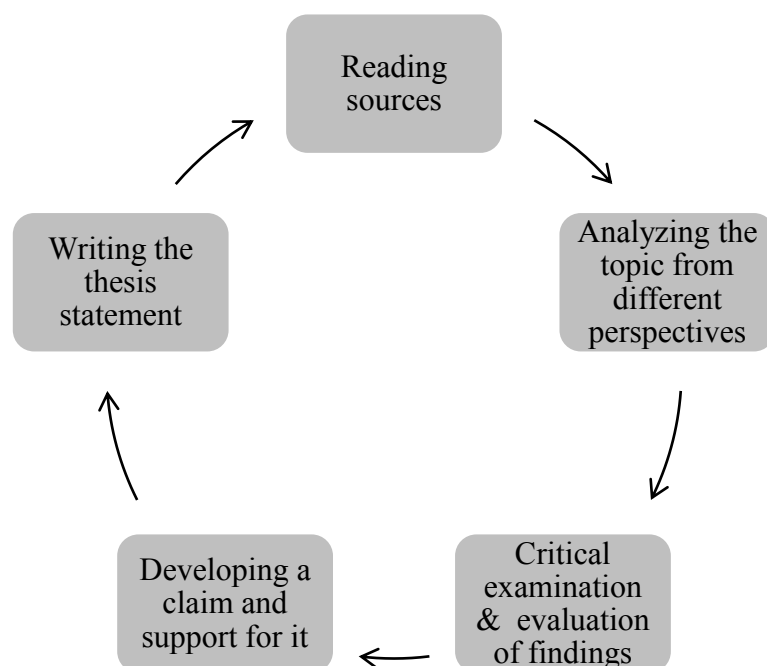
Reading about a topic from various sources will provide information that will help to analyze the topic from different perspectives. Critical examination of the information and evaluation of any findings will be necessary during this period.

There are various methods that can be used while dealing with a topic:

- |   |                                       |
|---|---------------------------------------|
| 1. advantages, benefits or gains        | 5. differences or similarities        |
| 2. drawbacks, dangers, threats or risks | 6. major areas of use or applications |
| 3. important factors; causes or effects | 7. methods or types                   |
| 4. problems or solutions                | 8. role or function                   |

Finally, integrating the claim with verifying support will lead to a strong thesis statement.

### The process of writing a thesis statement



### **Examples of persuasive thesis statements**

**Topic:** Devaluation of currency

**Thesis:** Developing countries must stop following policies of currency devaluation, as it reduces purchasing power, discourages national enterprise and makes economic acceptance harder in the international market.

**Topic:** The demolition of the Ataturk Cultural Centre

**Thesis:** The Ataturk Cultural Centre in Istanbul's Taksim Square should not be demolished due to the unique role it has played in the history, architectural development and social life of the Turkish Republic.

**Topic:** Dynamic city growth

**Thesis:** As the city region expands because of the rising population, it is important that the growth is "dynamic" as this provides the integration of the central business district with residential areas, easy accessibility into the city, and most important of all, sustainability in the growth of the city.

### **Examples of argumentative thesis statements**

**Topic:** Price discrimination

**Thesis:** In spite of the fact that price discrimination brings inequity, it is a very attractive strategy for some monopolistic firms because it maximizes profits, separates customers according to their expenditure limits, raises economic welfare, increases producer surplus and brings new customers into the market.

**Topic:** The effects of the BTC oil pipeline

**Thesis:** Despite the benefits of the Baku Tbilisi Ceyhan oil pipeline, the project presents clear dangers at its refineries, along the route of the pipeline itself and also at sea, as the oil is transferred and transported by ship.

**Topic:** RFID technology

**Thesis:** Although RFID can be costly to implement, it makes asset management and inventory warehouse applications more efficient, and also allows secure access control.

### **Examples of expository/ analytical thesis statements**

**Topic:** Prison architecture

**Thesis:** Prison architecture, which has a profound psychological impact on the lives of convicts, is usually determined by three main factors which are the realization of an architect's penal ideas, the requirements of government policy, and the constraint of funding.

**Topic:** Microorganisms

**Thesis:** Microorganisms can be utilized in many ways and their most common applications are in food production and preservation, in addition to their use as a food source themselves.

**Topic:** Bauhaus

**Thesis:** Bauhaus, a design school of the early twentieth century with an anti-academic character, helped create modern industrial product design through its focus on functionality, its marrying of technology and art and its educational strategy.

## **Outlining the paper**

Before starting to write, a well-planned outline must be prepared. An outline is the plan of the paper that will map the parts of the body of the paper in the order that they will appear. The outline must evolve from the thesis statement and be structured in an organized way. A paper based on an unstructured, disorganized outline will be confusing to read and it will be easy for the reader to become disinterested. Therefore, there must be a logical and fluent flow of ideas within the outline so that the reader can follow the ideas without being confused.

The outline can only be formed after careful analysis of sources, as it will be based on the information accumulated from the readings, and the divisions of the outline will reflect the research findings. Researchers cannot prepare an outline for a research paper without consulting sources. Unsubstantiated assertions cannot be part of the outline.

## **Steps for preparing a research paper outline**

The first step to take in the preparation of an organized outline is to make a list of all the relevant information acquired from various sources. Initially, any detail that may be of use should be included in the list. Later, after more consideration, those details that are unnecessary or redundant can be eliminated.

The outline will be made up of headings and sub headings. Thus, the second step is to group the listed ideas by placing similar and related ideas under the same headings. Headings must be arranged in coordination to make them equal to each other in terms of significance. Moreover, each heading will be divided into at least two further subheadings. Nevertheless, each outline is unique, especially in terms of the subheadings and the divisions listed under the headings.

The following example shows the process of brainstorming from sources to produce an outline.

Thesis: Despite being a recent technology, nanotechnology is proving to be an indispensable part of life by offering many solutions and improvements in medicine, creating materials in industry and providing opportunities for alternative means of energy.

As can be seen from this thesis statement, the advantageous uses of nanotechnology are studied within 3 main areas. Here are the ideas that come from various sources about the first usage field of nanotechnology:

### **I. Its use in medicine**

- Nanophosphors: Mini fluorescent phosphors used in detecting biological substances
- Cantilevers: Microscopic devices in the shape of tiny levers providing fast detection
- Nanowires: Nanoscale sensing wires used for detection
- Nanoshells: Tiny beads coated with metals such as gold, used to kill cancerous cells
- Nanoparticles: Nanodevices used for drug delivery
- Implants / sensor prostheses / artificial tissues / wound dressing

After collecting as many ideas as possible, they can be grouped in the form of an outline. Each major division of the thesis statement should be dealt with in a different section.

It is important to devise an outline around logical headings for sub-divisions. For the sake of clarity, parallel and consistent grammatical structures should be used whenever possible.

Taking into consideration the ideas listed under the division of nanotechnology in medicine, the subsequent headings could be formulated. The grouping of the section is seen below.

- Nanophosphors, cantilevers and nanowires provide efficient detection and can therefore be listed under “Diagnosis”.
- Nanoshells and nanoparticles are used in cancer therapy. Implants and sensor prostheses, artificial tissues and wound dressings are also new and promising ways of treatment in the case of organ loss or other kinds of injuries. Thus, these applications can all be listed under “Treatment”.

#### **I. In medicine**

##### **A. Quick and reliable diagnosis**

1. Nanophosphors
2. Cantilevers
3. Nanowires

##### **B. Effective treatment**



1. Fresh perspectives for cancer therapy
  - a. Nanoparticles
  - b. Nanoshells
2. New and promising products for other diseases and injuries
  - a. Implants and sensor prostheses
  - b. Artificial tissues
  - c. Wound dressing

Here are pieces of information found from sources about the use of nanotechnology in different fields of industry:

## **II. Its use in industry**

- Adding new functions to food products: on-demand foods, nutrients, increased bioavailability, longer shelf life, improved barrier functions, easy monitoring and tagging of food items, edible coatings
- Adding improved functions to vehicles: abrasion resistance, less weight and increased safety in cars / higher mechanical strength, aging resistance, reduction of wear and flammability, reduced risk of wings retaining ice, new propulsion systems leading to fuel efficiency in aircraft

Grouping these ideas under relevant headings can lead to an outline division as follows:

### **II. In industry**

#### **A. Nanotechnology applied to the food industry**

1. Food processing
  - a. On-demand foods
  - b. Nutrients
  - c. Bioavailability
  - d. Shelf life
2. Food packaging
  - a. Improving barrier functions: Mechanical, chemical, thermal and microbial properties
  - b. Monitoring and tagging of food items
  - c. Edible nano-coatings

#### **B. Nanotechnology applied to automotive and aerospace industry**

1. Automotive
  - a. Less friction and wear
  - b. Reduced weight
  - c. Increased safety

2. Aerospace
  - a. Mechanical enhancements
  - b. Added functions

Below are pieces of information found from sources about the use of nanotechnology in energy applications:

### **III. Its use in energy**

- Quantum dots: More efficient lighting in photovoltaics
- Nanofabrication of catalysts: Improved efficiency in fuel cells
- Nanoparticle coatings: Solution of the mercury problem
- Nanobatteries: Advanced battery technology

All this information found about the use of nanotechnology in the field of energy can be organized under section III as follows:

#### **III. In energy**

- A. Reduced energy consumption
  1. Increased efficiency in photovoltaics
  2. Increased efficiency in fuel cells
- B. Revolutionary environmentally friendly energy systems
  1. Solution to the mercury problem in broken bulbs
  2. Advanced battery technology

### **Suggestions that can be useful during the outlining and research process:**

- As the outline will be based on research findings it is important to organize the sources and the necessary information in them so that it becomes easy to find them later during the note taking stage and when preparing the reference list. While deciding about source information, **citations** for the chosen parts may be written on the outline. This will be useful when writing paragraphs, as the citations can then be easily added. The rules for citations are explained on pages 38-41.
- **Highlighting** the necessary information in the sources can also ease the writing process. Writing key words next to the highlighted parts of the sources, indicating both the **subject** and the **outline division**, will allow the easy location of each piece of information when writing paragraphs.

### **Outline of the nanotechnology paper with citations for the research findings:**

## Beneficial Usage Fields of Nanotechnology

Thesis: Despite being a recent technology, nanotechnology is proving to be an indispensable part of life by offering many solutions and improvements in medicine, creating advanced materials in industry and providing opportunities for alternative means of energy.

### I. In medicine

#### A. Diagnosis

1. Quantum dots (Bayer, 2009, pp. 39-40)
2. Nanophosphors (Bayer, 2009, pp. 38-41)
3. Cantilevers (Surendra, 2007, “Cantilevers”, para. 1-3)
4. Nanoparticles (Surendra, 2007, “Nanoparticles”, para. 1-2)

#### B. Treatment

1. Fresh perspectives for cancer therapy
  - a. Nanoparticles (Heath, Davis & Hood, 2009, p. 49)
  - b. Nanoshells (Surendra, 2007, “Nanoshells,” para. 1-3)
2. New and promising nanomedicine products being researched (Institution of Mechanical Engineers, n.d., para. 6-7, 9)
  - a. Implants and sensor prostheses
  - b. Artificial tissues

### II. In industry

#### A. Nanotechnology applied to food industry

1. Food processing
  - a. On-demand foods (Joseph & Morrison, 2006, p. 10)
  - b. Nutrients (Joseph & Morrison, 2006, p. 10; Miller & Senjen, 2008,

p. 12)

c. Bioavailability (Mozafari et al. cited in Miller & Senjen, 2006, pp. 13-14)

d. Shelf life (Miller & Senjen, 2008, pp. 12-13)

## 2. Food packaging

a. Improving barrier functions such as mechanical, chemical, thermal and microbial properties (Joseph & Morrison, 2006, pp. 7-8; see also Miller & Senjen, 2008, p. 16)

b. Monitoring and tagging of food items (Joseph & Morrison, 2006, p. 8)

c. Edible nano-coatings (Miller & Senjen, 2008, p. 15; Renton, Weiss & ElAmin cited in Miller & Senjen, 2008, p. 15)

## B. Nanotechnology applied to automotive and aerospace industry

### 1. Automotive

a. Cost and energy saving materials (Frost & Sullivan Research Service, 2004, para. 1-3, 14; “Nanotechnology-Based Lubricants”, 2009, para. 1)

b. High performance materials with less wear and reduced weight (“Nanotechnology-Based Lubricants”, 2009, para 1, 2, 6)

c. Increased safety (Birch, 2009, “Enhancing Safety,” para. 1)

### 2. Aerospace

a. Mechanical enhancements (Fidelus, Lewandoska, Bielinski & Malsch, 2007, pp. 18, 22; Meyyappan, 2007, para. 1-2, 4)

b. Added functionalities (Fidelus et al., 2007, p. 114)

## III. In energy

### A. Reducing of energy consumption

1. Increased efficiency in photovoltaics (Jenkins, 2005, para. 2-6)

2. Increased efficiency in fuel cells (“Energy Applications of Nanotechnology”, 2007, para. 1-3, 9-12)

B. Offering revolutionary environmentally friendly energy systems

1. Solution to the mercury problem in broken bulbs (Randhawa, 2008, p. 14)
2. Need for an advanced battery technology (McClellan, 2008, para. 1-2, 20, “Nano Details,” para. 1-3; “Revolutionary New Nanotechnology”, 2005, para. 3, 7; Front Edge Technology, 2008, “The World's Thinnest Rechargeable Battery”)

(The research paper of this outline is on pages 167-185)

Time and effort are required to establish a properly organized outline, well supported by relevant information from various documents. Any revisions of the outline will involve the arrangement of ideas, the addition and/or deletion of sources, along with the corrections in citations.

Also, during the process of adding new ideas to the outline sections, be careful not to duplicate information that already exists. An overlapping of ideas in previous or subsequent sections will lead to repetition in the text. Avoidance of such errors can only be made with an ongoing thorough examination of the ideas in different sections.

Although usually, corrections and improvements of outline sections made before writing the paper will suffice, they may, in some cases, require further revisions and alterations throughout the process of writing paragraphs until the final paper is submitted.

While note taking from sources and integrating them into the paragraphs, elimination of some sources or addition of newly found sources is natural as research is an ongoing process. Thus, it should be noted that the outline will serve as a basis of organization from which your paragraphs will evolve. Therefore, during the writing process, some changes in the outline and sources used may occur.

## **The format rules of the outline**

The outline also follows the basic formatting rules applied to all the other parts of the paper, which are 12 pt Times New Roman, 1 inch (2.5 cm) margins, double spacing between the lines, and left alignment.

### **Main components**

The title of the paper is included in the outline, and it must be written at the top left corner of the page. The first letter of each word in the title must be written in capital letters (articles and prepositions of less than 5 letters within the title are not capitalized). The thesis statement is entered two (double) spaces below the title. The major divisions of the paper, as indicated in the thesis, are entered in outline format.

### **Alternate use of numbers and letters to indicate the level of importance of the divisions**

Roman numerals (I II III) are used to show major divisions indicating the main ideas. Capital letters (A B C) are used to show the subordinate ideas. Arabic numbers (1 2 3) are used to show supporting details. Lowercase letters (a b c) are used to show further sub-divisions of supporting details.

### **Number of divisions**

Depending on the content of the research paper, some sections will have more subdivisions than others, but all divisions must contain at least two sub points. The same level symbols should have points that are equal in terms of importance.

### **Punctuation & Spacing**

Letters and numbers are followed by a period. After the period following each symbol (numbers & letters), two typewriter spaces must be given. However, as the topic outline consists of phrases and words only, no period is required at the end of entries.

### **Capitalization**

The first letter of the first word entered must be a capital letter; subsequent words are written with lowercase letters.

### **Language**

The notes for symbols at the same level (e.g. 1 and 2) should be written using parallel wording or grammar for easy reading and understanding.

**Example:**       A. Efficiency  
                      1. Longer battery life  
                      2. Higher speed

## **Sample outlines for different types of research papers**

The following two outlines have been organized for analytical papers

### **AK-47: The People's Choice**

Thesis: Designed according to principles established in World War II, the AK-47 has since become the world's most successful weapon not only because it is physically robust and reliable, but also due to its huge levels of availability which have given it a unique and iconic status in popular culture.

#### **I. Origins in World War II**

##### **A. German invasion of Russia**

1. Use of MP-40
2. Inadequacy of Soviet rifles

##### **B. Change in Soviet decision**

1. Switch to PPSH-41
2. Manufacture of PPSH-41

##### **C. Need for new type of weapon**

1. Development of MP-44
2. First use of "Assault Rifle"

##### **D. Soviet desire to match MP-44**

1. Design competition
2. AK-47 similarity to MP-44
3. Same mechanism as Garand M-1

#### **II. Robust and reliable design**

##### **A. Wide latitude in specifications**

1. Unreliability of main rival M-16 in Vietnam

2. AK-47 manufactured superiority
3. Continued reliability in Iraq

#### B. Effective

1. AK-47 specifications
2. M-16 specifications
3. Ammunition
  - a. 7.62mm vs 5.56mm
  - b. Supply of ammunition
4. Total number of weapons

#### C. Safer to use in combat

1. Straight sighting line
2. Total casualty figures

### III. Availability

#### A. Easy to use and supply

1. Few moving parts
2. Supply in Vietnam
3. Supply in Afghanistan

#### B. Cheap price

1. Cost after invasion of Iraq
2. Costs in other countries
3. Prices from weapons dealers

#### C. Adaptability

1. Removal of stock
2. Folding stock variant
3. Use by terrorists



D. Consequences of widespread supply

1. Total number of AK countries
2. Allende
3. Other international incidents

IV. Iconic status

A. Official use

1. Flag of Mozambique
2. Use on other flags and banners

B. Individual use

1. Osama Bin Ladin
2. Saddam Hussein
  - a. Import of AK copies and manufacture of Iraqi version
  - b. Capture in 2003
  - c. Gold-plated Kalashnikov

C. Growing popularity in the United States

1. Use by gangs
2. Display of weapons by criminals
3. Appearances on television news

D. Popularity in upmarket media

1. “50 Products that Changed the World”
2. BBC special documentaries
3. “Kalashnikov” song at 2008 Eurovision
4. War rugs of Afghanistan

E. Merchandising

1. AK-47 products

2. Kalashnikov vodka
3. Philippe Starck lamp

(The research paper of this outline is on pages 186-206)

## Understanding the Problem of Brain Drain

Thesis: The analysis of the causes and effects of brain drain both on the home country and the host country gives insight into this phenomenon, revealing that the probable solutions to it could be either to reverse it or profit from it.

### I. Reasons

#### A. Pull factors of the host country

1. Better education
2. Work opportunities

#### B. Push factors of the home country

1. Economic problems
2. Political instability
3. Lack of further education opportunities
4. Poor health services

### II. Negative effects on the home country

#### A. Fiscal costs

1. Loss of tax revenue
2. Loss of investment in education

#### B. Decrement in human capital

1. Reduced economic growth
2. Inadequate public services

### III. Solutions

#### A. Reversing the brain drain

1. Providing stable environment in the home country
  - a. Political stability
  - b. Socio-economic stability
2. Improving living conditions
  - a. Accommodation
  - b. Employment

#### B. Profiting from brain drain

1. By enabling knowledge transfer and sharing
  - a. Efforts of international organizations
  - b. Contribution of G8 countries
  - c. Role of the diaspora
2. By imposing brain drain tax
  - a. Baghwati proposal
  - b. Voluntary taxation proposal
3. By making service to country of origin mandatory

(Adapted from the work of Berat İnci, Çağatay Şensoy, Mustafa Mutlu Bayraktar & Tuğrul Cem Bıçak)

The following two outlines have been organized for persuasive papers

## Vernacular Architecture

Thesis: The time has come to re-evaluate vernacular architecture in recognition of the inherent rationality displayed in its relationship with the past and present, its suitability for local climate and materials, and its ability to meet the unique requirements of its users.

### I. Relationship with past and present

#### A. Evolution from one generation to next

1. Inherited knowledge and experience
2. Familiarity with the environment

#### B. Immunity to whims of fashion

1. Function vs. form
2. Vernacular as a tradition

#### C. Denial of the past in formal architecture

1. Revolution vs. evolution
2. Denial in roots of modernism

#### D. Style as a construct of formal architecture

1. Reflection of present fashion
2. Usage of international style
3. Imitation of vernacular design in modern architecture

### II. Suitability for local climate and materials

#### A. Climate

1. Temperature
  - a. Scandinavia
  - b. The Middle-East

- 2. Precipitation
  - a. Eastern Black Sea
  - b. The Mediterranean
- B. Materials
  - 1. Natural materials
  - 2. Man-made materials
- III. Ability to meet user requirements
  - A. With traditional vernacularity
    - 1. Self-built houses
    - 2. Houses built by builders
  - B. With today's urban vernacularity
    - 1. Synchronized design and construction stages
    - 2. Room as a basic module

(Adapted from the work of Emir Aykut Pekdemir)

## Reducing Personal Carbon Footprint

Thesis: People can reduce their own carbon footprint by paying attention to issues such as transportation, nutrition, heating and cooling and their use of electricity in their daily lives.

- I. Paying attention to transportation
  - A. Private transportation
    - 1. Vehicle choice
    - 2. Fuel type
    - 3. Driving style

B. Public transportation

1. Use of buses
2. Use of rail transit systems

II. Paying attention to nutrition

A. When shopping

1. Using local products
2. Eating lower energy consumption foods
3. Buying directly from producers
4. Reducing the packaging

B. When cooking

1. Cooking equipment
2. Cooking techniques

III. Paying attention to heating and cooling

A. Selection of proper energy source

1. Solar energy
2. Geothermal energy
3. Natural gas

B. Use of proper energy source efficiently

1. Insulation
2. Central heating

IV. Paying attention to electricity use

A. Less residential consumption

1. Switching off appliances
2. Avoiding stand-by mode
3. Switching off lights

4. Using timers to control appliances
- B. Less industrial consumption
1. Implementation of energy-efficiency policies
  2. Usage of waste-reduction measures

(Adapted from the work of Metin Tezcan, Dila Türkmen, Şamil Yılmaz and Said Gülşen)

The following outline has been organized for an argumentative paper

### E-Commerce: A New Phenomenon

Thesis: Although e-commerce has been criticized in regard to security risks, it is an excellent alternative to traditional commerce as it drastically reduces the consequences of the informal economy; it greatly facilitates the trading process and provides an excellent opportunity to gather valuable commercial information.

- I. Security risks
  - A. Unpredictable ventures with anonymous e-partners
    1. Hoaxes
    2. Inadequate global laws
    3. Expensive to pursue legal action in foreign countries
  - B. Credit card security risks
    1. Forgery
    2. Identity theft
- II. Limitation of the informal economy
  - A. Preventing tax evasion
    1. Registered transactions

- 2. E-governance
- B. Curbing the contraband products
  - 1. Internet law
  - 2. Smuggling
- III. Easier trading process
  - A. Advantages for companies
    - 1. Promotes global reach
    - 2. Enables electronic payment systems
  - B. Benefits for customers
    - 1. Cost savings
    - 2. Online auctions
    - 3. Tracking of transactions
- IV. Data collection
  - A. Data for firms
    - 1. Transaction databases
    - 2. Customer targeted advertising
  - B. Data for customers
    - 1. Easy and fast price comparison
    - 2. Access to global product reviews

(Adapted from the work of Mehmet Eren Küçükçolak, Yiğit Findik, Mert Bulut)



## Selecting appropriate sources for the research paper

Support for the argument should be based on a selection of different types of sources. Research findings should reflect a mixture of information from various experts in the field and not be heavily dependent on a single source. The following is a possible list of both printed and online sources.

### Print sources

- Books, edited books, handbooks, translated books
- Encyclopedias
- Dictionaries
- Professional & academic journals
- Popular magazines & newspapers
- Reports & master's theses or doctoral dissertations
- Conference papers
- Brochures & catalogues
- Course handouts
- Government publications

### Online sources

- E-books, abstracts
- Popular electronic magazines & newspapers
- Professional & academic electronic journals
- Electronic encyclopedias
- Online dictionaries
- Electronic versions of print sources
- Sources from a database
- Course handouts of instructors on a university web page
- Government publications
- Reports
- Master's theses or doctoral dissertations
- Conference papers
- Patents

Ongoing research is essential to become better acquainted with the topic and to develop a more thorough understanding and awareness. Reading more literature allows the accumulation of more information, but should be done on a selective basis, locating relevant and useful information while eliminating irrelevant points. Defense with evidence creates a credible paper.

## Source choice and evaluation

When searching for a good quality source it is advisable to check for reliability. Accuracy, objectivity, and validity are important especially in terms of the content of articles and the credibility and qualification of authors are also matters that require attention when evaluating the reliability of a source.

Not all information found on the web necessarily comprises good, reliable information.

- Professional and scholarly journals and magazines can be counted as good sources as they usually contain articles written by experts in the field. Many sources of this type can also be found on databases.
- Use of reliable statistical data, tables, figures and pictures can help to provide evidence or illustrate a point.
- Blogs and personal websites should be avoided as they are not inclined to use sound information and generally may contain information that is not based on facts. Also, as information placed on wiki sites is continuously being altered and amended by people, they are not ideal sources to use in research however informative they may be.
- Dates must be checked to ensure that material presented is current and valid. Outdated articles will most likely not offer relevant information pertaining to the contemporary world, particularly in the field of science.
- There is a variety of online sources some of which are suitable to be used in academic research. When choosing sources from the internet, it is important to pay attention to domain name extensions as sources with extensions such as “edu” (educational institutions), “gov” (government) and “org” (organization) are usually more reliable.
- Web sites that are owned by private companies trying to promote products are not ideal sources to refer to, as there will be substantial bias involved.
- Grammatical errors and spelling mistakes in writing indicate that the material may not be reliable. A selection of sources free of such errors should be made.
- The credibility of the writer of an article is also an important point to consider. Ideally, when citing outside sources in a research paper, the aim is to refer to expert knowledge. Authors’ credibility can be checked through their websites, paying attention to

published articles in journals and employment details and association with organizations or institutions with considerable reputation. In addition, if the author in question has had work cited in other sources, that would also indicate credibility.

### Organizing the relevant information in sources

The sources selected for the research paper will be cited both in the text and on the references page; therefore, it is crucial to note all the necessary information. Both the content, in terms of the specific pages used, and the reference information will be needed.

Each type of source will require different elements for the references. For **print sources**, the reference information includes details such as the writer(s), the title(s), the date and the publication information.

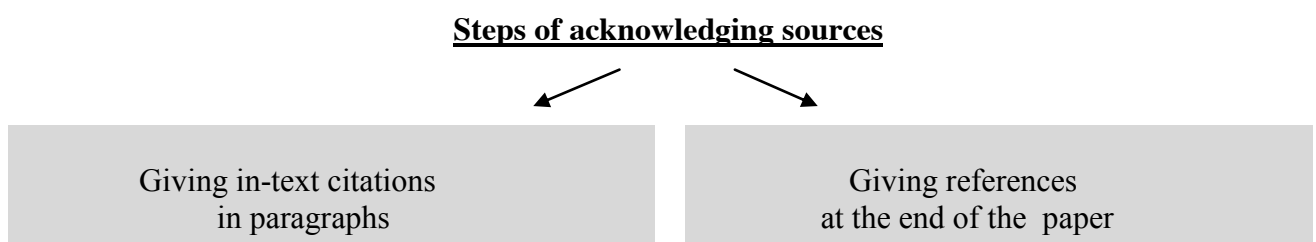
1. For example, when using a **book** as a source, the pages on which there is information about the writer, the date and place of publication, the publisher etc. (usually, the first two pages of the book contain this information) will be needed when writing citations and references.
  - An **edited** book includes either different chapters or articles, each written by different writers and compiled by an editor(s) or different chapters or articles with no writers specified for each chapter / article and only the name of the editor(s) given on the cover. The “Contents” page of a book is the best place to refer to in order to determine what kind of edited book it is. On this page, all the chapters and articles will be listed with writers either indicated or not.
  - Also, a **book translated** into English may be used. In this case, the name of the translator as well as the original writer of the book will be needed. In addition to the date of publication of the translated book, the publication date of the original work will also need to be noted down.
2. While using a **magazine** or a **journal** as a source, the volume and issue number and the pages of the article will be necessary. All this information appears on the cover page and “Contents” page.
3. The same type of information will be required for other types of sources such as **reports, master’s theses or doctoral dissertations, conference papers, brochures and catalogues** as well.
4. For **patents**, knowing the patent number, the inventor and the office that issued it is crucial.

For **web sources**, as well as the reference information including writer(s), date, title and volume/issue numbers for sources such as periodicals/journals/magazines, the locator information must also be saved. Digital Object Identifier [DOI] numbers have started to be assigned for the identification of intellectual property in the digital environment. Therefore, if the DOI number is available for an online article, it must be saved for use in the references later on. If no DOI is available, then the URL must be used.

## Acknowledging sources

Reading a wide variety of sources and citing them in the paper shows how extensive the research is. Research increases the reliability and value of any academic work. A research paper that cites information from diverse and reputable sources gains credibility.

Acknowledgement of sources is a requisite for academic and scientific research. Every researcher must give credit to the original writers of any information that they have used in their own work. Sources must be cited in the body of the paper, and for each citation a reference entry containing more detailed information about the source must be written.



An APA in-text citation is composed of 3 pieces of information: the surname of the writer, the date and the page number.

(Schröder, 1986, p. 14)

This abbreviated information about each source represents an entry in the “References” page. The reference entry provides all the necessary information to retrieve or gain access to the original source for further reading.

Schröder, G. (1986). Communication and standardization in the context of a global CIM concept. In T. Bernold & W. Guttropf (Eds.), *Computer integrated manufacturing: Communication / standardization / interfaces* (pp. 1-26). Amsterdam: Elsevier Science Publishers.

A citation within the text is only meaningful when there is a reference entry for it, which denotes all the essential information about the source. Therefore, citing a source means both giving in-text citations and providing a list of references at the end of the paper.

Giving citations and references is a necessary means to avoid plagiarism, which is a serious violation of academic rules. Acknowledging the original source is a legal requirement.

## Citing sources in text

When using a specific part of a source as a paraphrase, summary or quotation, the standard citation format is giving the surname of the writer, the date and the page number.

(Riedinger, 2000, p. 12)

However, when referring to the entire content of a source, the citation includes only the writer's surname and the date. There is no need to give a page number.

(Riedinger, 2000)

There will be different and special cases regarding the 3 basic elements of citation.

**Sources with 1 writer:** Always include the surname of the writer in the citation. There is no need to give the writer's first name or initials.

(Bagwell, 2007, p. 1703)

**Sources with 2 writers:** Always include the surnames of both writers in the citation. Use ampersand (&) in between.

(Leyens & Peters, 2003, p. 393)

If the source has 2 writers with the same surname, the initials of both writers are also included in the citation for clarity.

(G. E. Belch & M. A. Belch, 1998, p. 690)      (M. Lüsted & G. Lüsted, 2005, p. 13)

**Sources with 3-5 writers:** If a source is written by 3-5 writers, in the first citation, the names of all writers must be given; however in subsequent citations, put the first writer's surname followed by **et al.**, which is a Latin abbreviation for "and others".

First citation: (Armstrong, Flowers, Spears & Nielsent, 2002, p. 155)

Any later times: (Armstrong et al., 2002, p. 160)

**Sources with 6 or more writers:** If there are 6 or more writers, put the first writer's surname followed by et al. in all citations.

(Gubler et al., 2005, p. 3)

**Edited sources:** When using an edited book, check to see whether or not the book includes different chapters written by different writers. In the absence of different writers for chapters in the book, the editor(s) will be used in the citation.

Editors: N. M. Cameron & M. E. Mitchell      Citation: (Cameron & Mitchell, 2007, p. 227).

However, if the chapters in the edited book have been written by different writers, then the writer(s) of the chapter should be used in the citation. In such compiled books, the editor will be indicated on the cover, whereas the individual writers will be found inside in the “Table of Contents” page.

Editors: T. Bernold & W. Guttropf     Writer of the article: A. S. Liss     Citation: (Liss, 1986, p. 58)

**Sources written by an organization:** Sometimes, there is no individual writer for a source. In this case, check to see if it has been produced by an organization, institution, company or university, all of which can be used in the place of the writer in the citation.

(EPA, 1997, para. 1)     (GMO Compass, 2006, para. 3)     (The Soil Association, 2010, para. 1)

**Sources with no writer:** If there is no individual writer or an institution, then as the first part of the citation, give the title of the article. Capitalize the major words (all words except articles, pronouns, prepositions and auxiliary verbs of less than four letters) and put the title in quotation marks.

(“Nanotechnology Kills Cancer Cells”, 2005, para. 2)

If the title is a very long one, shorten it by choosing the most significant part of it.

Original title: Nanoliposomes and their applications in food nanotechnology

Citation with shortened title: (“Nanoliposomes”, 2008, p. 310)

**Sources without a date:** In some online sources, no date is available. In this situation, write **n.d.**, which means no date is given.

(Silvaram, & Kulkarni, n.d., para. 1)     (“Global Positioning System”, n.d., p. 1)

**Citing multiple pages:** When paraphrasing, summarizing or quoting information which appears on multiple pages, use **pp.** before the page numbers. Continuous pages are separated by a hyphen, whereas discontinuous pages are separated by a comma.

(Stauffer, 2006, pp. 118-120)     (Stauffer, 2006, pp. 118, 121)

**Online sources without original page numbers:** Some sources on the web do not include original page numbers. Although page numbers may appear on them when printed, they are, in fact, only the numbers the printer gives them. If the page numbers cannot be seen on the screen prior to printing, to show which part of the source has been used, apply paragraph numbers and/or section titles, whichever is available. If possible, both paragraph number and section title should be provided for a more straightforward location. Before the paragraph numbers, the abbreviation para. or the pilcrow sign (¶) can be used. The section title should be given in quotation marks.

(Dorfman, 2004, ¶10)     (Calzolaio, 2008, “Land Degradation” section)

(Sweet, 1999, “Expert System”, para. 5 - 6)

**Citing multiple sources:** When making use of information from multiple sources and incorporating them in a paraphrase or summary, give the citations of all the sources used in the same parenthesis by separating them with semicolons. Mention the sources in alphabetical order.

(Bagwell, 2007, pp. 1703-1704; Leyens & Peters, 2003, p. 394)

If the writer wants the readers to refer to another source for the same kind of information, the phrase “see also” can be used before giving the citation of the suggested source(s) for further reading. In this case, the sources that are written after the phrase “see also” should be given in alphabetical order.

(Nelson, 1974, pp. 729-730; see also Bagwell, 2007, p. 1703; Liss, 1986, p. 58)

**Citing an entire chapter:** To refer to a chapter as a whole, follow the format below.

(Rehg & Kraebber, 2005, Chapter 2)

**Indirect information in a source:** When using a source where there is a citation indicating that the information has been taken from another source, both sources must be cited. To give the citation for indirect information that has been taken from another source, first refer to the writer (or for anonymous works, the title) of the secondary source in parenthesis followed by “**cited in**” or “**quoted in**” and then write the rest of the citation pertaining to the primary source.

A paraphrase or summary from a secondary source:

<b>Secondary writer</b>	<b>writers of the primary source</b>
-------------------------	--------------------------------------



(McConnell cited in Messenger & Goswami, 2007, pp. 23-57)

A quotation from a secondary source:

(Çetinkaya quoted in Uğur & Şimşek, 1993, p. 555)

Secondary source with no writer:

(“Patient’s Dilemma” cited in Crooker, Baldwin & Chalasani, 2009, p. 169)

**Patent citation:** Only give the patent number for in-text citations of patents.

(U.S. Patent No. 4,648,783)

## Preparing references for sources used

As mentioned earlier, in-text citations and a matching list of references are the two critical elements of proper acknowledgment. The aim of writing an in-text citation is for the reader to be able to locate the original source from which the cited information has come. Therefore, each in-text citation must have a corresponding reference entry. References must be prepared thoroughly and precisely, applying the standard rules of the style being followed.

### The main rules for giving references in APA style

1. The “References” must be listed in **alphabetical order**. Alphabetization is by the surname of the writer or organization. If there is no writer, the alphabetization is by the title of the work. While alphabetizing sources with multiple writers, do not change the order of the writers on the cover of the book. They should stay in the same order as in the original.
2. The entries are not numbered or bulleted. The list of references is typed using **hanging indentation** set at **0.5" (1.27 cm)**.
3. Each source entry ends with a **period** except for online sources with a web address at the end.

### How to alphabetize the sources in the reference list

1. The titles which begin with “**a**,” “**an**” or “**the**” are alphabetized by the first word after the article. The reference entry below would therefore count as “g” in the alphabetical order.  
  
The growing world population. (1994, March). *Population and Development*, 20, 233-238.
2. Titles which **begin with a number** are alphabetized considering the pronunciation of that number. The following reference entry would therefore count as “s” in the alphabetical order.

*7 reasons why Google Chrome, the new Google browser, is a bad idea*. (2008). Retrieved from <http://seo2.0.onreact.com/7-reasons-why-google-chrome-the-new-google-browser-is-a-bad-idea>

3. When using a **source written by a writer who is also the co-writer of another source** cited in the paper, enter the source with the single writer first in the reference list.

Zairi, M. (1999). *Benchmarking for best practice*. Bodmin, Cornwall: MPG Books Ltd.

Zairi, M., & Leonard, P. (1996). *Practical benchmarking: The complete guide*. London: Chapman & Hall.



4. If references are to be prepared for sources by the same writer(s), they are put in date order. The one written earlier is entered first.

Bajaj, P., & Sengupta, A. K. (1985). Industrial applications of textiles: Textiles for filtration and coated fabrics. *Textile Progress*, 14(1), 1-39.

Bajaj, P., & Sengupta, A. K. (1992). Protective clothing. *The Textile Institute*, 22(2, 3, 4), 1-68.

5. If **both the writers and the dates are the same**, then they are alphabetized by the title. For the sake of clarity, lowercase “a” and lowercase “b” are added after the date both in the reference entry and in the citation.

Sayers, R. (2010a). British economy shows fastest growth since 2001. *The First Post*. Retrieved from <http://www.thefirstpost.co.uk/67789,business,high-street-sales-hit-three-year-high-cbi-sales-above-predictions-retail>

Sayers, R. (2010b). High Street sales hit three-year high. *The First Post*. Retrieved from <http://www.thefirstpost.co.uk/67843,business,uk-economy-boosted-by-construction-sector>

6. If two sources have **multiple writers** and if the **first writers of the two sources are the same**, alphabetize by the second writer’s surname.

Chen, W. F., & Duan, L. (2003). *Bridge engineering: Seismic design*. Boca Raton, Florida: CRC Press.

Chen, W. F., & Lui, E. M. (2006). *Earthquake engineering for structural design*. Boca Raton, Florida: Taylor & Francis.

7. If the writers of two different sources have **the same surname** but are **not the same writers**, alphabetize by their initials and always mention the initials in the citations in text.

Muller, C. (1998). *Magnetic levitation for transportation*. Retrieved from [www.railserve.com/maglev.html](http://www.railserve.com/maglev.html)

Muller, R. (2003, July). A pollution-free hydrogen economy? Not so soon. *Technology Review*. Retrieved from <http://www.technologyreview.com/Energy/13259/page2/>

## Format rules for APA style references

### 1. WRITER

In all source entries, the information about the **writer** is provided first unless it is an anonymous work. In this part, only the surname and initials of the writer are given. If there are multiple writers, put the symbol ampersand (&) between the last two writers.

Mckenzie, D.

Gethmann, C. F., & Thiele, F.

Botvin, G. J., Goldberg, C. J., Botvin, E. M., & Dusenbury, L.

For the reference entry of sources with **8 or more writers**, the first 6 writers are written in succession followed by **an ellipsis (...)**, and the entry is completed with the last writer.

Newman, S. T., Nassehi, A., Xu, X. W., Rosso, R. S., Wang, L., Yusof, Y., ..., Dhokia, V.

(2008, December). Strategic advantages of interoperability for global manufacturing using CNC technology. *Robotics and Computer-Integrated Manufacturing*, 24(2008), 699-708. Retrieved from <http://portal.acm.org/citation.cfm?id=1411002>

If there is no writer's name, but rather an **organization**, write the acronym for the organization in parenthesis after writing it in full form first.

British Wind Energy Association (BWEA).

## 2. DATE

The **date** is always the second unit in a reference entry, whether there is an available writer or not. For most sources, only the year is written. For magazines, the month is added and for newspapers, the exact date is written.

**Books, encyclopedias, reports, conference papers, stand-alone internet articles etc.:** (2001)

**Article in a magazine:** (2009, December)

**Article in a newspaper:** (2006, September 10)

**No date available:** (n.d.)

## 3. TITLE OF SOURCES

**These titles will be in italics**

abstracts  
books / e-books  
conference papers  
encyclopedias  
journals / magazines / newspapers  
doctoral dissertations / master's theses  
reports

**Do not put these titles in italics**

articles in a magazine / journal /  
newspaper  
  
articles in an encyclopedia  
  
chapters in an edited book

**These titles will be capitalized**  
(First letter of each major word)

encyclopedias  
journals  
magazines  
newspapers

**Do not capitalize these titles**

articles in a magazine, journal or  
newspaper and in an encyclopedia  
books / e-books / edited books  
chapters in edited books  
conference papers  
reports - master's theses  
stand-alone internet articles

If the source is **of a special edition** such as a revised, expanded or numbered edition, this information is given in parenthesis as follows.

*The management and control of quality* (7<sup>th</sup> ed.).

*Management* (Rev. ed.).

*When not to build* (exp. ed.).

#### 4. PUBLICATION INFORMATION for books

All book entries end in the same way. First, the **publication place** is provided followed by a 'colon', and then the name of the **publishing company** is given.

New York: Springer.

London: Chapman & Hall.

#### 5. VOLUME/ISSUE/PAGE NUMBERS for magazines, journals & newspapers

While ending a journal or magazine entry, first the **volume number** is written in **italics**, then the **issue number** is given in **parenthesis**, and finally the first and last **page numbers** of the article are written in **regular** type face.

Newspapers do not have volume or issue numbers, in which case **only the page numbers** are given following the abbreviation p. or pp.

**Magazine:** *PC World*, 26(8), 82-90.

**Newspaper:** *The Economist*, pp. 72-75.

## 6. DOI or URL for web sources

If a **Digital Object Identifier (DOI)**, which is an alphanumerical unit, is available for an online document, it should be used in the references. DOI numbers are used for easy location of articles on the web.

doi: 10.1080/00207720500438480

The insertion of the DOI number into the browser's location bar will immediately lead to the particular article that is being searched.

For example, for doi: **10.1038/ncponc0024**, type:

<http://dx.doi.org/10.1038/ncponc0024>

This will take you to the entrance page of the desired article.

If a DOI number is not available, use the **Uniform Resource Locator (URL)** in your references.

Retrieved from <http://www.nanoforum.org>

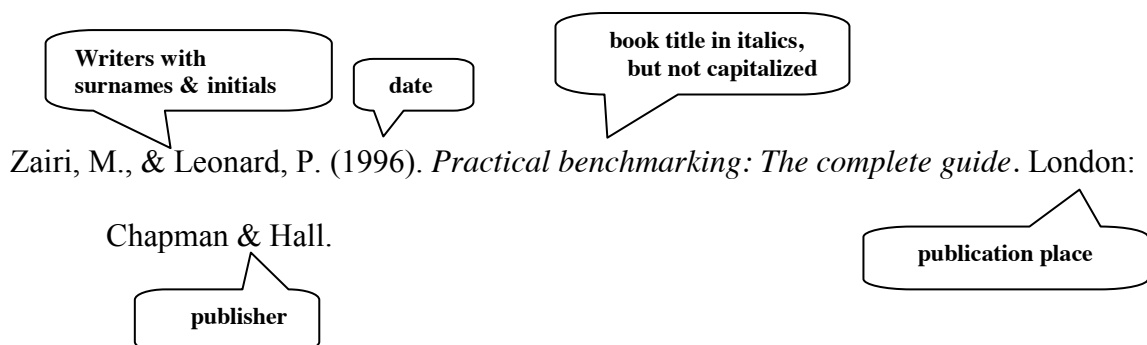
**Retrieval dates** are included for documents that may be changed, edited, modified or deleted.

Retrieved December 25, 2009, from <http://solveclimate.com/blog/20080721/altair-nanotechnologys-battery-faster-cooler-more-efficient>

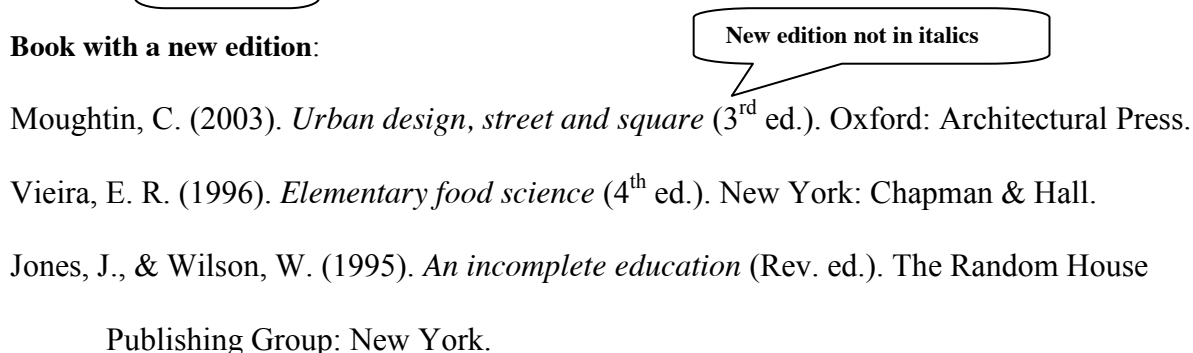
While typing references, make sure the web address is not underlined and/or in blue. If it is, **remove the hyperlink**. Also, if the web address is to be divided, it should be done before the punctuation.

## Source reference examples with explanations

### 1. Reference entry of **BOOKS** is given as follows:

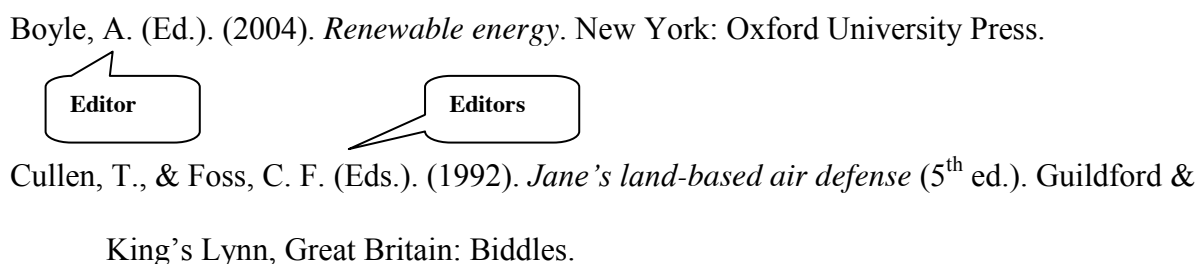


### Book with a new edition:

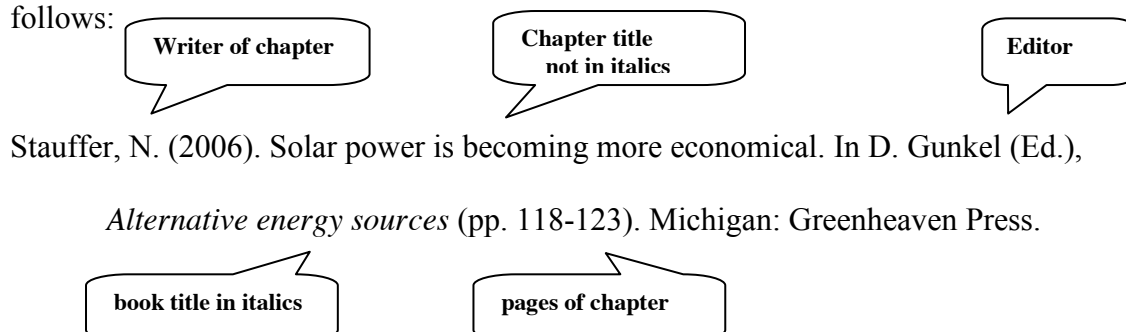


### 2. Reference entry of **EDITED BOOKS** depends on the type of edited book.

Edited books in which there are **no separate chapters written by different writers** are entered as follows:



Edited books in which the **chapters have been written by different writers** are entered as follows:



Liss, A. S. (1986). Planning, justification and implementation of a CIM solution. In T.

Bernold & W. Guttropf (Eds.), *Computer integrated manufacturing: Communication /standardization/interfaces* (pp. 57-82). Amsterdam: Elsevier Science Publishers.

Breakey, J., Reilly, C., & Conell, H. (2002). The role of food additives and chemicals in behavioral, learning, activity, and sleep problems in children. In A. L. Branen, P. M. Davidson, S. Salminen & J. H. Thorngate. (Eds.), *Food additives* (2<sup>nd</sup> ed., rev. & exp; pp. 87-100). New York: Marcel Dekker.

Second edition, revised and expanded

**3.** In the reference entry of a **NON-ENGLISH BOOK**, the English translation of the title is given in brackets after the original title.

Non-English title

English translation of title

Ünalın, Ö. (2004). *Darwin ne yaptı?* [What did Darwin do?]. Papirüs Yayınevi: İstanbul.

Şen, Z. (2002). *Temiz enerji ve kaynakları* [Clean energy and its sources]. Su Vakfı Yayınları: İstanbul.

**4.** In the reference entry of a **TRANSLATED BOOK**, the name of the translator(s) are given after the title as follows:

date of translated version

Belitz, H. D., & Grosch, W. (1999). *Food chemistry* (2<sup>nd</sup> ed.) (M. Burghagen, D. Hadziyev, P. Hessel, S. Jordan, & C. Sprinz, Trans). New York: Springer. (Original work published in 1987)

Translators

date of original version

## 5. Reference entry of a **HANDBOOK**

Murphy, R. R., Tadokoro, S., Nardi, D., Jacoff, A., Fiorini, P., Choset, H., & Erkmen, A. M. (2008). Search and rescue robotics. In B. Siciliano & O. Khatib (Eds.), *Springer handbook of robotics* (pp. 1160-1164). Würzburg: Stürtz GmbH.

## 6. Reference entry of an **E-BOOK**

Kruckenber, T. M., & Paton, R. (Eds.). (1998). *Resin transfer moulding for aerospace structures*. E-book: Kluwer Academic Publishers. Retrieved from <http://books.google.com/books?id=v-cxZ38lFMMC&printsec=frontcover&hl=tr>

URL

## 7. Reference entry of an **ENCYCLOPEDIA ARTICLE**

chapter / article title not in italics or capitalized

encyclopedia title in italics and capitalized

Quantum mechanics. (1992). In *The New Encyclopedia Britannica* (Vol. IX, p. 841). Chicago: Encyclopedia Britannica.

The word “In” at the beginning of the encyclopedia title (not italicised)

Insulation. (1988). In *The World Book Encyclopedia* (Vol. X, p. 308). Chicago: World Book.

## 8. Reference entry of an **ELECTRONIC ENCYCLOPEDIA ARTICLE**

Wood, M. B. (2007). Nuclear energy: Technology. In *Encyclopedia of Energy Engineering and Technology* (Vol. I, II, III). Florida: CRC Press. doi: 10.1201/9780849338960.ch131

doi

Atmanspacher, H. (2011). Quantum approaches to consciousness. In *The Stanford Encyclopedia of Philosophy*. Retrieved from <http://plato.stanford.edu/archives/sum2011/entries/qt-consciousness/>

URL



## 9. Reference entry of a **MAGAZINE ARTICLE**

Segan, S., & Gideon, T. (2007, December). Fast, friendly multimedia marvel. *PC Magazine*, 26(24), 38-41.

magazine title in italics and capitalized

article title not in italics or capitalized

volume number in italics, issue number in parenthesis, with no space in between & page numbers of article regular

Waurzyniak, P. (2001, January). CAD/CAM tools raise the bar. *Manufacturing Engineering*, 126(1), 52-60.

**Magazine article with no writer** is entered as follows:

Change is in the air. (2008, April). *PC Magazine*, 27(5), 25.

article title at the beginning

A **magazine article with no writer, no volume or issue number** is entered as follows:

Sheets and quilt covers. (2004, June/July). *TurkishTime Sectors*, 155-165.

page numbers

## 10. Reference entry of a **NON-ENGLISH ARTICLE in a MAGAZINE**

Taşgetiren, S. (1998). Rüzgar enerjisi [Wind energy]. *Ekoloji Dergisi*, 8(29), 25-30.

English translation of article title in brackets

## 11. Reference entry of an **ELECTRONIC MAGAZINE ARTICLE**

Preising, B., Hsia, T. C., & Mittelstadt, B. (1991, June). A literature review: Robots in medicine. *IEEE Engineering in Medicine and Biology Magazine*, 10(2), 13-22.

Retrieved from <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=82001&tag=1>

URL

If the magazine article is retrieved from an **electronic database**, give the URL of the online archive. The example below is the reference of an article retrieved from **ERIC database**.

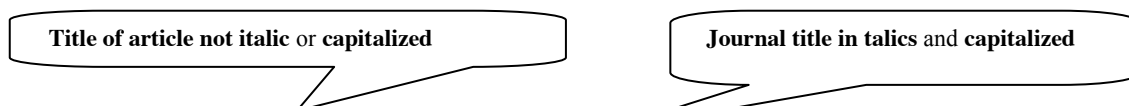
Colony, L., & Foster, C. (2011, January). The technician beneath our wings, or is that blades?  
*Techniques: Connecting Education and Careers*, 86(1), 30-31. Retrieved from  
<http://www.eric.ed.gov/PDFS/EJ926035.pdf>

If **no volume/issue/page numbers** are available for a magazine, the entry is as follows:

Davis, S. (2012, January). Hybrid flywheel system extends UPS run times with batteries.  
*Power Electronics Technology*. Retrieved from [http://powerelectronics.com/power\\_electronic\\_systems/ups/hybrid-flywheel-system-extends-ups-run-times-0112/](http://powerelectronics.com/power_electronic_systems/ups/hybrid-flywheel-system-extends-ups-run-times-0112/)

## 12. Reference entry of a **JOURNAL ARTICLE**

Parasuraman, R. (1997). Humans and automation: Use, misuse, disuse, abuse. *Human Factors*, 39(2), 249.



Rendall, W. (1986). Mies revival. *The Architects' Journal*, 183(18), 40-46.

## 13. Reference entry of an **ELECTRONIC JOURNAL ARTICLE**

Paul, R., Bautista, L., Varga, M., Botet, J., Casals, E., Puntès, V. & Marsal, F. (2010, March). Nano-cotton fabrics with high ultraviolet protection. *Textile Research Journal*, 80(5), 454-462. doi: 10.1177/0040517509342316

doi

Casbeer, D. W., Kingston, D. B., Beard, R. W., & McLain, T. W. (2004). Cooperative forest fire surveillance using a team of small unmanned air vehicles. *International Journal of System Science*, 37(6), 357-359. doi: 10.1080/00207720500438480

If there is **no doi number**, the **URL** is provided.

Simon, R. A. (2003, January). Adverse reactions to food additives. *Current Allergy and Asthma Reports*, 3(1), 62-66. Retrieved from <http://www.springerlink.com/content/d6v65956177228k2/>



URL

Perdue, W. C. (2003, September). The built environment and its relationships to the public health: The legal framework. *American Journal of Public Health*, 93(9), 1390- 1394. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1447979/>

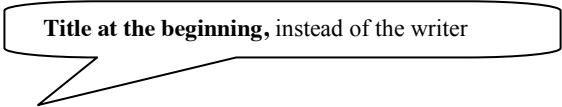
If the journal article is from an **electronic database**, then provide the **URL** of the online archive. For example, the following article is retrieved from **JSTOR database**.

Neumann, D. (1995). The century's triumph in lighting: The Luxfer Prism Companies and their contribution to early modern architecture. *The Journal of the Society of Architectural Historians*, 54(1), 24-53. Retrieved from <http://www.jstor.org/pss/991024>

#### 14. Reference entry of a **NEWSPAPER ARTICLE**

Kopytoff, V. G. (2010, November 24). Rival ordered to pay Oracle over \$1 billion. *The New York Times*, p. 1.

**The writer of the newspaper article** may not be stated. In this case, enter it as follows:



Title at the beginning, instead of the writer

Drawdown in Iraq. (2011, July 13). *The New York Times*, p. 26.

**15. Reference entry of an ELECTRONIC NEWSPAPER ARTICLE**

year, month & day  
for newspapers

article title not in italics  
or capitalized

newspaper title in italics and  
capitalized

Lean, G. (2008, January 20). Mobile phone radiation wrecks your sleep. *The Independent*.

Retrieved from <http://www.independent.co.uk/life-style/health-and-Wellbeing/health-news/mobile-phone-radiation-wrecks-your-sleep-771262.html>

Williams, R. (2009, January 29). Honda's impossible dream. *The Guardian*. Retrieved from

<http://www.guardian.co.uk/commentisfree/2009/jan/29/honda-formula-one-bail-out>

**16. Reference entry of a NON-ENGLISH ARTICLE in a NEWSPAPER retrieved online**

English translation of article title  
in brackets

Özdil, Y. (2011, June 4). Öğretmen [The teacher]. *Hürriyet*. Retrieved from

<http://www.hurriyet.com.tr>

Erdem, Ö. (2010, July 15). Tuzla'da iş kazası: 1 ölü [Tuzla work accident: 1 fatality].

*Hürriyet*. Retrieved from <http://hurarsiv.hurriyet.com.tr/gosterShowNew.aspx?id=15326786>

**17. Reference entry of a CATALOGUE or BROCHURE**

catalogue in brackets

Bavarian Motor Works [BMW]. (2006). *BMW 6 Series* [Catalogue]. Germany.

**18. Reference entry of a CATALOGUE or BROCHURE retrieved online**

Health and Safety Executive [HSE]. (1999). *Safe use of petrol in garages* [Brochure].

Retrieved from <http://www.hse.gov.uk/pubns/indg331.pdf>

brochure in brackets

Boron CLS Bond. (n.d.). *The biodegradable, high performance, anti-corrosive lubrication technology* [Brochure]. Retrieved from <http://www.biolubrication.com/brochure.pdf>

#### **19. Reference entry of an ABSTRACT**

Although it is recommended to give reference for the full text of an article, it is possible to use only abstracts as a source.

Schlooz, W. A. J. M. & Hulstijn, W. (2012, January-March). Atypical visuomotor performance in children with PDD [Abstract]. *Research in Autism Spectrum Disorders*, 6(1), 326-336.

#### **20. Reference entry of an ABSTRACT retrieved online**

Conrad, K. J., Iris, M., Ridings, J. W., Langley, K., & Anetzberder, G. J. (2010). Self-report measure of psychological abuse of older adults. *The Gerontologist*, 51(3), 354-366.  
Abstract retrieved from <http://gerontologist.oxfordjournals.org/content/51/3/354.abstract>

If available, provide **accession number**.

Conrad, K. J., Iris, M., & Ridings, J. W. (2009). *Conceptualizing and measuring financial exploitation and psychological abuse of elderly individuals*. Abstract retrieved from National Criminal Justice Reference Service Abstracts database. (Accession No. 228632)

#### **21. Reference entry of a STAND-ALONE ARTICLE from the WEB**

##### **Individual writer:**

Bojowald, M. (2005). *Loop quantum cosmology*. Retrieved from <http://relativity.livingreviews.org/Articles/lrr-2005-11/>

**Organization:**

American Wind Energy Association [AWEA]. (2005). *The economics of wind energy*.

Retrieved from <http://www.awea.org/pubs/factsheets/EconomicsOfWind-Feb2005.pdf>

Center of American Progress. (2007). *The top 100 effects of global warming*. Retrieved from [http://www.americanprogress.org/issues/2007/09/climate\\_100.html](http://www.americanprogress.org/issues/2007/09/climate_100.html)

**No individual writer, no organization:**

title at the beginning

*The bombing of Hiroshima and Nagasaki*. (n.d.). Retrieved from <http://www.vce.com/hironaga.html>

**22. Reference entry of a NON-ENGLISH STAND-ALONE ARTICLE from the WEB**

English translation of the title

Bal, Ç. (2005). *DNA ve kuantum deneyleri* [DNA and quantum experiments]. Retrieved from [http://www.zamandayolculuk.com/cetinbalHTMLdosya1/DNA\\_KuantumDeneyleri.htm](http://www.zamandayolculuk.com/cetinbalHTMLdosya1/DNA_KuantumDeneyleri.htm)

**23. Reference entry of an ARTICLE from a UNIVERSITY WEB SITE**

*UQ researchers make breakthrough in renewable energy materials*. (2008). Retrieved from

The University of Queensland Web Site: <http://www.uq.edu.au/news/index.html?article=14818>

name of university before web address

Lang, A., Paravicini, D., Pigneur, Y., & Revaz, E. (2002). *From customer relationship management (CRM) to supplier relationship management (SRM)*. Retrieved from Université de Lausanne Web site: <http://inforge.unil.ch/yp/Pub/02-SRM.pdf>

**24. Reference entry of MASTER’S THESES or DOCTORAL DISSERTATIONS**

Altindemir, E. (2008). *Hibrid elektrikli tasitlarda rejeneratif frenleme* [Regenerative braking on hybrid electric vehicles]. Unpublished master’s thesis, Istanbul Technical University, Istanbul, Turkey.

master’s thesis after the title

Atabay, B. (2010). *Doğal ve yapay ışığın mekanı anlamlandırma gücü ve bir arada bulunma dinamikleri* [The power of natural and artificial light in giving meaning to space and the dynamics of their coexistence]. Unpublished doctoral dissertation, Istanbul Technical University, Istanbul, Turkey.

doctoral dissertation after the title

**25. Reference entry of MASTER’S THESES or DOCTORAL DISSERTATIONS from the WEB**

Li, N. (2011). *Preserving urban landscapes as public history: A qualitative study of Kensington Market, Toronto*. Unpublished doctoral dissertation. Retrieved from [http://scholarworks.umass.edu/open\\_access\\_dissertations/341](http://scholarworks.umass.edu/open_access_dissertations/341)

**26. Reference entry of UNPUBLISHED CONFERENCE PAPERS**

Işık, F. T. (2004). *Keeping it full: The meaning of the refrigerator for domestic consumption and reproduction in modern everyday life in Turkey*. Paper presented at the Fourth International Conference on Design and Emotion, METU, Ankara, Turkey.

**27. Reference entry of CONFERENCE PAPERS compiled in an EDITED BOOK**

Ureyen, M. E., Çavdar, A., Koparal, A. S., & Dogan, A. (2009, June). *Nano in textile, agriculture and food science*. Fifth National Nanoscience and Nanotechnology

Conference (pp. 403-419). Eskişehir, Turkey: Anadolu Üniversitesi İleri Teknolojiler Araştırma Birimi Yayınları.

**28. Reference entry of CONFERENCE PAPERS retrieved from the WEB**

Edgü, E., & Ünlü, A. (2003). *Relation of domestic space preferences with space syntax parameters*. Paper presented at the 4th Space Syntax Symposium London 2003. Retrieved from <http://www.spacesyntax.org/symposia/SSS4/fullpapers/82Edgu-Unlupaper.pdf>

Hollmuller, P., Lachal, B., & Zraggen, J. (2006, 6-8 September). *A new ventilation and thermal storage technique for passive cooling of buildings: Thermal phase-shifting*. Paper presented at The 23rd Conference on Passive and Low Energy Architecture 2006. Retrieved from [www.bfe.admin.ch/php/modules/publikationen/stream.php](http://www.bfe.admin.ch/php/modules/publikationen/stream.php)

**29. Reference entry of REPORTS published as AN EDITED BOOK**

Pachauri, R. K., & Reisinger, A. (Eds.). (2008). *Climate change 2007: Synthesis report*. Geneva: IPCC.

**30. Reference entry of REPORTS retrieved from the WEB**

Nieuwlaar, E., & Alsema, E. (1997). *Environmental aspects of PV power systems*. (Issue Brief No: 97072). Retrieved from <http://www.ecotopia.com/apollo2/pvenv1997.pdf>

Nelson, P. A. (H. T. Harvey & Associates). (2008). *Developing wave energy in coastal California: Potential socio-economic and environmental effects*. Public Interest Energy Research Program Final Project Report (Issue Brief No: CEC-500-2008-083). Retrieved from <http://www.energy.ca.gov/2008publications/CEC-500-2008-083/CEC-500-2008-083.PDF>



### 31. Reference entry of a **MOTION PICTURE**

Abrams, J. J. (Producer). (2009). *Star trek*. [Motion picture]. United States: Paramount Pictures.



patent number in italics

### 32. Reference entry of a **PATENT**

Brown, D. C. (2007). *United States Patent No. 7221552*. Washington, DC: U.S. Patent and Trademark Office.

Kenji, M. (2005). *European Patent No. 1739065 B1*. Rotterdam: European Patent Office.

**Studying the following reference entries and trying to identify the type of source in each entry will help to clarify the APA reference list formatting rules.**

Ancrenaz, M., Dabek, L., & O'Neil, S. (2007). The costs of exclusion: Recognizing a role for local communities in biodiversity conservation. *PLoS Biology*, 5(11), 2443-2448.  
doi:10.1371/journal.pbio.0050289

Cantrell, B., & Michaels, W. (2010). *Digital design for landscape architecture: Contemporary techniques and tools for digital representation in site design*. E-book: John Wiley & Sons, Inc. Retrieved from <http://www.ebooks.com/ebooks/book-display.asp?IID=487648>

Conway, H. (2000). Parks and people: The social functions. In J. Woudstra & K. Field (Eds.), *The regeneration of public parks* (pp. 9-20). London: E & FN Spon.

Dumlu, D. (2007). *The devil's blessing: Harry Truman and international control of the atomic bomb, September 1945-June 1946*. Unpublished master's thesis. Retrieved from [http://www.bilkent.edu.tr/~history/index\\_files/MAAndPhDTheses.htm](http://www.bilkent.edu.tr/~history/index_files/MAAndPhDTheses.htm)

EROWID. (n.d.) *Caffeine effects*. Retrieved from <http://www.erowid.org/chemical/caffeine/caffeine-effects.shtml>

- 5 reasons why ERP & CRM are even more important during a recession.* (2009). Retrieved from <http://jobfunctions.bnet.com/abstract.aspx?docid=1108423>
- Fredholm, B. B., Bättig, K., Holmén, J., Nehlig, A., & Zwartau, E. (Eds.). (1999, March). Actions of caffeine in the brain with special reference to factors that contribute to its widespread use. *British Journal of Clinical Pharmacology*, 51(1), 105-107.
- Gay, D., Hoa, S. V., & Tsai, S. W. (2003). *Composite materials design and applications*. USA: CRC Press LLC.
- Healey, H. M. (1997). Cost-effective solar applications of commercial and industrial facilities. *Energy Engineering*, 94(4) 34-50. Retrieved from <http://proquest.umi.com/pgdweb?did=13553189&Fmt=4&clientId=36097&RQT=309&VName=PQD>
- How do gasoline and electric vehicles compare?* (n.d.). Retrieved from <http://avt.inel.gov/pdf/fsev/compare.pdf>
- Jones, A. R., Gladstone, W., & Hacking, N. J. (2007, December). The Australian sandy-beach ecosystems and climate change: Ecology and management. *Australian Zoologist*, 34(2), 190-203.
- Mateus, T., & Oliveria, A. C. (2009, June). Energy and economic analysis of an integrated solar absorption cooling and heating system in different building types and climates. *Applied Energy*, 86(6), 949-957.
- Montgomery, R. H., & Budnick, J. (1978). *The solar decision book*. New York: John Wiley and Sons.
- Qiu, Z., Chong, W., & Liyuan, Z. (2009). *Cost of long span cable-stayed bridges with application of high strength steel*. Paper presented at International Conference on Transportation Engineering 2009, China. Retrieved from <http://www.ascelibrary.org>

Robotic Institute of America. (1979). *Learn about how the terms 'robot' and 'robotics' came about and get a brief introduction to the history of robotics*. Retrieved from [http://www.robotics.utexas.edu/rrg/learn\\_more/history/](http://www.robotics.utexas.edu/rrg/learn_more/history/)

Secreteriat of the Convention on Biological Diversity. (2009). *Connecting biodiversity and climate change mitigation and adaptation: Report of the second ad hoc technical expert group on biodiversity and climate change*. Montreal: Secreteriat of the CBD.

Williamson, V. M., & Abraham, M. R. (1993, August 2). The effects of computer animation on the particulate mental models of college chemistry students. *Journal of Research in Science Teaching*, 5(32), 521-534. doi: 10.1002/tea.3660320508

## Comparison between in-text citations & references

In text	In reference list
<b>Book – one writer</b> (Kalogirou, 2009, p. 667)	Kalogirou, S. A. (2009). <i>The solar engineering: Processes and systems</i> . Burlington, MA: Elsevier.
<b>Book- two or more writers</b> (Gay, Hoa & Tsai, 2003, p. 33)	Gay, D., Hoa, S. V., & Tsai, S.W. (2003). <i>Composite materials design and applications</i> . Florida, USA: CRC Press LLC.
<b>Translated book</b> (Finkenzeller, 2003, pp. 347-348)	Finkenzeller, K. (2003). <i>RFID handbook: Fundamentals and applications in contactless smart cards and identification</i> (2 <sup>nd</sup> ed.) (R. Waddington, Trans). England: John Wiley & Sons Ltd. (Original work published in 1999)
<b>Book with a new edition</b> (Hull & Clyne, 1996, p. 25)	Hull, D., & Clyne, T. W. (1996). <i>An introduction to composite materials</i> (2 <sup>nd</sup> ed.). Cambridge: Cambridge University Press.
<b>Chapter/article in an edited book</b> (Farber, 1981, p. 95)	Farber, E. A. (1981). Office tower reaches the sun. In R. L. Koral (Ed.), <i>Foundations of the solar future</i> (pp. 92-102). Atlanta: The Fairmont Press.
<b>Journal article</b> (Katan & Schouten, 2005, p. 539)	Katan, M. B., & Schouten, E. (2005, March). Caffeine and arrhythmia. <i>The American Journal of Clinical Nutrition</i> , 81(3), 539-540.
<b>Journal article with 6 writers</b> (Lapsa et al., 2007, pp. 14-16)	Lapsa, M. V., Maxey, L. C., Earl, D. D., Beshears, D. L., Ward, C. D., & Parks, J. E. (2007, July 1). Hybrid solar lighting provides energy savings and reduces waste heat. <i>Energy Engineering</i> , 104(4), 8-20.

<b>Online journal article</b> (Kirigia, Gbary, Muthuri, Nyoni, & Seddoh, 2006, “Methods”)	Kirigia, J. M., Gbary, A. R., Muthuri, L. K., Nyoni, J., & Seddoh, A. (2006). The cost of health professionals’ brain drain in Kenya. <i>BMC Health Services Research</i> , 6(89). doi:10.1186/1472-6963-6-89.
<b>In text</b>	<b>In reference list</b>
<b>Online journal article with indirect information</b> (Vogel cited in Bhushan, 2003, p. 1475)	Bhushan, B. (2009). Biomimetics; Lesson from nature – an overview. <i>Philosophical Transactions of the Royal Society</i> , 367(1893), 1445-1486. doi: 10.1098/rsif.2010.0487
<b>Online journal article retrieved from a database</b> (Ziêbowicz, Dobrzański, Drak & Wydrzyńska, 2008, pp. 90-92)	Ziêbowicz, B., Dobrzański, L. A., Drak, M., & Wydrzyńska, M. (2008, April). Corrosion resistance of composite materials Fe <sub>73.5</sub> , Cu <sub>1</sub> , Nb <sub>3</sub> , Si <sub>13.5</sub> , B <sub>9</sub> – PE type in acid environment. <i>Archives of Materials Science and Engineering</i> , 30(2), 89-92. Retrieved from <a href="http://www.archivesmse.org/vol30_2/3026.pdf">http://www.archivesmse.org/vol30_2/3026.pdf</a>
<b>Stand alone article by a university</b> (Lund University, 2009, “Nanotechnology in Food Processing”, para. 1)	Lund University. (2009). <i>Nanotechnology in food processing, packaging and safety</i> . Retrieved from <a href="http://www.lu.se/upload/LUPDF/LU_Education/Nanotechnology%20in%20Food%20Processing,PackagingandSafety.pdf">http://www.lu.se/upload/LUPDF/LU_Education/Nanotechnology%20in%20Food%20Processing,PackagingandSafety.pdf</a>
<b>Stand alone article by a corporate writer</b> (e.g. an association, institution or government department) (CSIC, 1999, pp. 1-3)	Coffee Science Information Center [CSIC]. (1999) <i>Coffee and gastrointestinal function</i> . Retrieved from <a href="http://www.cosic.org/coffee-and-health/gastrointestinal-function">http://www.cosic.org/coffee-and-health/gastrointestinal-function</a> .
<b>Stand alone article without writer</b> (“Solar Water Heating Value”, n.d., para. 3, 9)	<i>Solar water heating value</i> . (n.d.). Retrieved from <a href="http://www.calseia.org/solar-water-heating-value.html">http://www.calseia.org/solar-water-heating-value.html</a>

<b>Conference paper retrieved from the web</b> (Landman, 2002, p. 7)	Landman, K. (2002). <i>Gated communities in South Africa: Building bridges or barriers?</i> Paper presented at International Conference on Private Urban Governance 2002. Retrieved from <a href="http://www.gatedcomsa.co.za/docs/bridges_barriers.pdf">http://www.gatedcomsa.co.za/docs/bridges_barriers.pdf</a>
<b>Report retrieved from the web</b> (Kliesch & Langer, 2006, pp. 4, 9)	Kliesch, J., & Langer, T. (2006). <i>Plug-in hybrids: An environmental and economic performance outlook</i> (Report number: T06). Retrieved from <a href="http://www.aceee.org/pubs/t061.pdf">http://www.aceee.org/pubs/t061.pdf</a>
<b>In text</b>	<b>In reference list</b>
<b>Report retrieved from the web</b> (Kliesch & Langer, 2006, pp. 4, 9)	Kliesch, J., & Langer, T. (2006). <i>Plug-in hybrids: An environmental and economic performance outlook</i> (Report number: T06). Retrieved from <a href="http://www.aceee.org/pubs/t061.pdf">http://www.aceee.org/pubs/t061.pdf</a>
<b>Online news portal with no writer</b> ("Fast Food as Addictive as Heroin", 2003, para. 2-5)	Fast food as addictive as heroin. (2003, January 30). <i>BBC News</i> . Retrieved July 7, 2010, from <a href="http://news.bbc.co.uk/2/hi/health/2707143.stm">http://news.bbc.co.uk/2/hi/health/2707143.stm</a>
<b>Online encyclopedia</b> (WRI, 2009, "Scope of the Problem")	World Resources Institute. (2009). Alien species transport via ship ballast water. In <i>Encyclopedia of Earth</i> . Retrieved from <a href="http://www.eoearth.org/article/The_expansion_of_invasive_species_through_ship_ballast_water?topic=49480">http://www.eoearth.org/article/The_expansion_of_invasive_species_through_ship_ballast_water?topic=49480</a>
<b>Online encyclopedia with no writer</b> ("Historical Development of Automation", n.d., para. 1-2)	Historical development of automation. (n.d.). In <i>Encyclopedia Britannica</i> . Retrieved from <a href="http://www.britannica.com/EBchecked/topic/44912/automation">http://www.britannica.com/EBchecked/topic/44912/automation</a>
<b>Patent</b> (U.S. Patent No. 5,429,365)	Mckeighen, J. F. (1995). <i>U.S. Patent No. 5,429,365</i> . California: U.S. Patent and Trademark Office.

## DRAFTING PROCESS

Drafting is a process used to arrange and prepare paragraphs by following steps such as writing topic sentences, note taking with proper citations, commenting on source information and writing concluding sentences.

### **Paragraphing**

The claims made and the ideas presented to support the thesis statement will have to be explained within the body of the paper. This will consist of a number of paragraphs, all of which will follow major divisions specified in the thesis statement. The details in the body paragraphs should follow the outline.

### **Organization of paragraphs according to the outline**

The Roman numerals (I II III) of an outline represent the major sections of the paper. These are the main divisions written in the thesis statement. Each main division will have its own topic sentence.

- The capital letters (A B C) are paragraphs within a section that explain the subordinate ideas within the major divisions. A, B and C will be written as separate paragraphs and will be introduced by topic sentences.
- The Arabic numbers (1 2 3) and lowercase letters (a b c) are supporting points, examples and other evidence from source material. Each piece of evidence will be introduced by a subtopic sentence. All information taken from sources requires a citation.
- Evidence presented as support will be preceded or followed by personal comments and inferences.
- Finally, a paragraph will end with a concluding sentence.

The following diagram illustrates the **three main components** for the composition of a paragraph

**Topic & subtopic sentences**



for introducing main  
and subordinate ideas

**Supporting sentences**



for presenting research  
findings combined with  
writer's original comments

**Concluding sentence(s)**



for ending the paragraph

A paragraph should show **unity and coherence**. Unity means the paragraph is centered and developed around only one main idea. Coherence refers to the sentences in the paragraph flowing smoothly and logically.

A research paper paragraph comprises both the writer's original ideas and the supporting details from the sources that will convince the reader that the writer's claims are all true. An orderly and coherent organization of all this information will make it a more effective paragraph.

Here is a sample organization for a paragraph both for A & B divisions.

**Paragraph I A**

- Topic sentence for I
- Topic sentence for A
- Subtopic sentence for A 1
- Research findings for A 1 and lower-case a, b, etc. if there are any
- Writer's comment and evaluation
- Subtopic sentence for A 2
- Research findings for A 2 and lower-case a, b, etc. if there are any
- Writer's comment and evaluation
- Concluding sentence for A

**Paragraph I B**

- Topic sentence for B
- Subtopic sentence for B 1
- Research findings for B 1 and lower-case a, b, etc. if there are any
- Writer's comment and evaluation
- Subtopic sentence for B 2
- Research findings for B 2 and lower-case a, b, etc. if there are any
- Writer's comment and evaluation
- Concluding sentence for B

Depending on the content requirements or fluency purposes, more than one topic, subtopic or concluding sentence may be used. Alternatively, combining topic and subtopic sentences can sometimes help to avoid unnecessary repetition.



## **Writing topic & subtopic sentences**

Each major division of the thesis statement is expanded and described in at least two paragraphs, and every paragraph in the body of the paper begins with a topic sentence.

The topic sentence describes the paragraph as a whole and makes a claim that is supported in the paragraph by giving explanations and details. Therefore, all the ensuing sentences in the paragraph have to be connected and controlled by the topic sentence.

Apart from the topic sentences that introduce the main and subordinate ideas of the paragraph, within the paragraph, there are also subtopic sentences written for the purpose of organizing the supporting details and presenting the research findings. In this way, fluency in expression and smoothness in the flow of ideas can be established.

## **Using the outline for preparing topic and subtopic sentences**

The outline is used to prepare topic and subtopic sentences. Each division in the outline can be transformed into a grammatically correct and complete sentence.

- The A and subsequent paragraphs will each begin with a separate topic sentence. However, the A paragraphs will differ from the other paragraphs in that they will always start with the topic sentence that explains the main idea indicated by the Roman numeral (I II ...) and be followed by the subordinate idea indicated by A.
- Therefore, A paragraphs will be introduced by two topic sentences, whereas the remaining paragraphs (B C ...) will be introduced only by one topic sentence.
- The subdivisions in the outline shown by the Arabic numbers (1 2 3 ...) and lowercase letters if any (a b ...) will serve as the subtopic sentences introducing the supporting details.

## **Using proper transition signals while writing topic sentences**

- To ensure clarity and to set up a connection between all the topic sentences of the paper, writers should make use of various structures.
- It is recommended to use a different transition signal for every topic and subtopic sentence.

## **Preparing topic sentences for the main ideas in the Roman numerals (I, II & III)**

If the major divisions are made up of three adjectives describing the advantages of a topic like the ones below, the topic sentences for them can be worded as follows or in other similar ways:

**Argument:** DNA technology has many advantages.

### **Main ideas for the argument:**

- I. Fast
- II. Accurate
- III. Practical

### **Topic sentences for the main ideas:**

- I. The first significant benefit of DNA technology is the fact that it provides fast analysis.
- II. The second advantage of DNA technology is that it increases the accuracy of test and analysis results.
- III. The final positive outcome provided by DNA technology is the practicality of testing and analysis.

If the major divisions are made up of beneficial usage fields like the ones below, then the topic sentences for them can be written as in the following examples or in other similar ways:

**Argument:** DNA technology has many beneficial areas of use.

### **Main ideas for the argument:**

- I. Medicine
- II. Forensic science
- III. Environmental protection

### **Topic sentences for the main ideas:**

- I. The first and most important usage field which can benefit from DNA technology is medicine.
- II. The second field where remarkable benefits can be gained by using DNA technology is forensic science.
- III. Finally, DNA technology can be an invaluable tool when applied for environmental protection.

If the major ideas are useful applications like the ones listed below, the topic sentences for them can be constructed like the following examples:

**Argument:** Radio Frequency Identification (RFID) is one of the most advantageous methods of automatic identification technology due to its various applicable areas.

### **Main ideas for the argument:**

- I. Asset management applications
- II. Inventory-warehouse applications

### III. Security and access control applications

#### **Topic sentences for the main ideas:**

- I. Asset management is the primary area that benefits from RFID technology.
- II. Secondly, inventory-warehouse is also facilitated via RFID technology.
- III. Finally, RFID is also highly preferred for security and access control applications.

Sometimes, the supporting ideas can be worded in longer phrases. The topic sentences for the major divisions below could be written in a similar way to the following examples:

**Argument:** Online shopping is the best way to purchase many items.

#### **Main ideas for the argument:**

- I. Providing ease and convenience in purchasing
- II. Offering a wide variety of products from different brands
- III. Enabling economical shopping by allowing price comparison

#### **Topic sentences for the main ideas:**

- I. Firstly, online shopping allows ease and convenience when purchasing goods.
- II. The second remarkable advantage of online shopping is the fact that it offers a wide variety of products from many different brands.
- III. The final superiority of online shopping is that it enables economical shopping by price comparisons.

If the major divisions contain a counter idea, then the topic sentences should be organized carefully, making the focus clear. A transition will be necessary in the form of either a short separate transitional paragraph or additional information within the topic sentence in order to lead the reader from one idea to the next without creating any confusion. In the following example, a separate transitional paragraph has been prepared to provide a connection.

**Argument:** Wave power is not an ideal type of energy.

#### **Main ideas for the argument:**

- I. Zero pollution (advantage)
- II. Inconsistent and unpredictable production (disadvantage)
- III. Ecological impacts (disadvantage)

#### **Topic sentences for the main ideas and the transitional paragraph before the topic sentence for II:**

- I. The only beneficial characteristic of wave energy is the fact that it causes zero pollution.

Transitional paragraph before the topic sentence for II: For an energy type to be ideal, it should have more remarkable characteristics than just being green. It is a well-known fact that the world needs a

clean energy type, but this clean energy type should also be efficient and economical. Unfortunately, wave power does not offer these benefits.

- II. The first and most striking negative aspect of wave energy is the fact that its production is inconsistent and unpredictable, which makes it inefficient.
- III. Another serious concern wave energy presents is the fact that it may bring about detrimental ecological changes.

The major divisions below also contain a counter idea, but the argument here is positive, stating that nanotechnology is beneficial. This should be clarified after the explanation of potential dangers. Here the transition from one idea to the other is shown within the topic sentence for II.

Thesis: Although some believe the theory that an out-of-control nanoproces could result in the conversion of the entire Earth to “grey goo” in less than 48 hours, nanotechnology’s advantages for medicine, manufacturing and computer science must be developed and exploited.

**Main ideas for the argument:**

- I. Grey goo scenario
- II. Medical advantages
- III. Manufacturing advantages
- IV. Computer science advantages

**Topic sentences for the main ideas:**

- I. The “grey goo” scenario describes a situation where nanomachines simply build more of themselves rather than following any kind of control, converting any material to continue this process until there is no more left.
- II. Although it is true that almost all industries and technologies have had unforeseen results, the advantages of working at the nano-scale are too great to refuse. The first, and perhaps most important, area for nanotechnology is medicine.
- III. In addition to medicine, nanotechnology also offers huge benefits to manufacturing as products can be made by growing materials and parts rather than reducing them from larger volumes and pieces.
- IV. Finally, nanotechnology will revolutionize computer science by allowing the development of molecule-sized hardware.

**Preparing topic sentences for the ideas in the Capital letters (A B C) and subtopic sentences for the ideas in Arabic numbers (1 2 3) and lowercase letters (a b c)**

Each major division in the outline (**I II III & IV**) is divided into at least two subordinate divisions (**A B C**), and later into a minimum of two further subdivisions (**1 2 3**). When necessary, the number of divisions may increase and the subdivisions for supporting details can also be divided into additional sections (**a b c**).

The topic sentences introducing all these ideas should begin with appropriate transition signals.

A and B topic sentences are the two divisions of I. Therefore, the **A topic sentences** should be preceded by transition signals like the ones below:

To begin with - To start with - Above all - In the first place - First and foremost

The **B topic sentences** should, however, begin in a different way, clarifying the fact that they are the second divisions of I. It is also possible to remind readers of the idea stated in A by rephrasing it within the B topic sentence. Here are some suggestions for transition signals for B topic sentences:

Without mentioning the idea in A:

The next ... Another ... A further ...

Mentioning the idea in A:

In addition to - Apart from - Aside from - Besides - Not only .. but also..

The **subdivisions for Arabic numbers (1 2 3)** are usually two or more examples or reasons, etc.; therefore, the transition signals for these sub-topic sentences should show that clearly.

For example - As an example - Primarily - Most importantly - One reason for that → **for 1**

Another example - Another reason for that - Furthermore - Moreover - What is more

In addition - Additionally → **for the subsequent divisions (2, 3)**

**The following topic and subtopic sentences about ‘Green Buildings’ show how the transition signals have been used.**

I. Efficiency of green buildings

A. In terms of energy consumption

1. Reduction of heating and cooling requirement
2. Reduction of electricity requirement

B. In terms of water consumption

1. Harvest stormwater and rainwater
2. Reuse greywater and blackwater

**I. The first** significant advantage offered by green buildings is their efficiency.

**A. Above all,** green buildings consume less energy, which provides great operational savings.

**1. Primarily,** they ease the huge financial burden by reducing heating and cooling expenses.

**2. Furthermore,** residents end up paying smaller electricity bills as green buildings lower electricity consumption.

**B. As well as** their efficiency in energy consumption, green buildings are also efficient in terms of water usage

**1. For example,** stormwater and rainwater are harvested in these buildings for later use.

**2. Additionally,** the reuse of greywater and blackwater in green buildings helps decrease water consumption.

## **Sample topic and sentence outlines for comparison**

The sentence outline on the next page shows how each division in the topic outline below has been converted into a sentence ready to be used within the corresponding paragraph.

### **Computer Integrated Manufacturing**

Thesis: Even though application of CIM may sometimes be problematic, it must be applied to manufacturing businesses as it increases efficiency and quality.

#### **I. Complexity of the system**

##### **A. Problems originating from the system itself**

1. High-involvement system
2. High-priced system

##### **B. Problems originating from people who do not get the gist of CIM**

1. Uneducated managers
2. Untrained employees

#### **II. Efficiency**

##### **A. Time efficiency**

1. Reducing cycle time
2. Reducing lead time

##### **B. Economic efficiency**

1. Higher productivity
2. Less cost
  - a. Inventory costs
  - b. Labor costs
  - c. Manufacturing costs

### III. Increasing quality

#### A. Product quality

1. Increasing flawless manufacturing
2. Increasing quality control

#### B. Work environment quality

1. Increasing workers' convenience
2. Increasing worker safety

### Improving Business with Computer Integrated Manufacturing

Thesis: Even though application of CIM may sometimes be problematic, it must be applied to manufacturing businesses as it increases efficiency and quality.

#### I. A significant drawback involving CIM application can be stated as the complexity of the system.

##### A. To begin with, problems that originate from the system itself must not be underestimated.

1. One of these is that CIM is a high-involvement system
2. Another disadvantage is that CIM is a high-priced system.

##### B. Apart from the problems arising from the system, there are also problems that are created by the staff that do not fully comprehend the workings of CIM.

1. For instance, there is the problem of uneducated managers.
2. Moreover, untrained personnel also pose various difficulties.

#### II. Despite the drawbacks that the problems mentioned above can create, CIM is in fact an advantageous system that offers undeniable efficiency.



- A. To start with, time efficiency can be advantageous.
  - 1. Most importantly, cycle time is reduced considerably.
  - 2. Furthermore, a reduction in lead time can also be achieved with CIM.
- B. Not only time efficiency, but also economic efficiency is provided through the application of CIM.
  - 1. One reason for that is the attainment of higher productivity.
  - 2. Additionally, there is a reduction in various costs.
    - a. One example that can be given for this is the decrease in inventory costs
    - b. A second factor is labor costs.
    - c. Finally, manufacturing costs can also be considerably curbed by implementing CIM.

III. A second remarkable benefit of CIM application is the increase in quality.

- A. First and foremost, the quality of the product is enhanced.
  - 1. Primarily, manufacturing quality increases when CIM is utilized.
  - 2. What is more, quality control of the manufactured goods is elevated.
- B. Besides an increase in product quality, the quality of the work environment is also raised.
  - 1. One of the ways of achieving this is by creating a more convenient workplace.
  - 2. Another way to boost the quality of the workplace is to provide maximum worker safety.

(Adapted from the work of Mustafa Orhun Ayan, Çağlar Alper Kaya, Sinem Bayram & Özge Vatansever)

Below is another sample sentence outline about nanotechnology and its application areas. The topic outline of this paper is on pages 19-21 and the whole research paper is on pages 159-177.

### Beneficial Usage Fields of Nanotechnology

Thesis: Despite being a recent technology, nanotechnology is proving to be an indispensable part of life by offering many solutions and improvements in medicine, creating advanced materials in industry and providing opportunities for alternative means of energy.

#### I. The first significant application of nanotechnology is in medicine.

A. To begin with, there are useful applications of nanotechnology in diagnosing techniques.

1. In the past, quantum dots were used in diagnosing.
2. At this point, nanophosphors seemed to have more efficient usage in diagnosis.
3. Furthermore, cantilevers are efficient molecular detection tools for diagnosis.
4. Finally, nanoparticles can also be used as a diagnostic tool.

B. Apart from diagnosis, nanotechnology is also applied successfully in medical treatments.

1. Most importantly, nanotechnology introduces “fresh perspectives” for cancer therapy.
2. Additionally, new promising nanomedicine products can be the key for fatal diseases.

#### II. The second outstanding usage field of nanotechnology is in industry.

A. To start with, nanotechnology can be applied to the food industry.

1. As an example, nanotechnology can modify food processing methods.

2. Moreover, another application of nanotechnology within the food sector is in food packaging.
- B. Aside from the food industry, nanotechnology also provides beneficial usage areas in both automotive and aerospace industries.
1. For example, nanotechnology offers new perspectives for the automotive sector.
  2. Also, the aerospace sector can progress with nanotechnology.
- III. The third remarkable utilization area of nanotechnology is in energy.
- A. Above all, energy consumption can be reduced by nanotechnology.
1. For example, nanotechnology offers more efficiency in photovoltaics.
  2. Moreover, nanotechnology also helps to provide increased efficiency in fuel cells.
- B. In addition to the reduction of energy consumption, nanotechnology also has significant superiority in revolutionary environmentally-friendly systems.
1. For instance, nanotechnology offers a solution to the mercury problem in broken bulbs.
  2. What is more, nanotechnology helps to improve battery technology.

**(topic outline ve paper da yapılan değişikliklerle karşılaştır)**

## **Notetaking from sources through paraphrasing, summarizing and quoting**

The second step in the drafting process is note taking. This is a very important process and all writers should show utmost care not to plagiarize. Presenting someone else's ideas without giving them credit is considered theft in the academic world. Apart from being intentional, plagiarism can be committed unintentionally through insufficient use of paraphrasing or summarizing. In order to refrain from plagiarism, writers will need to reword sentences through paraphrases and summaries, or use direct quotations as well as write proper in-text citations for every piece of information taken from sources. To avoid the use of too many "direct quotations", writers must learn the skills needed to present source material in their own words by using paraphrases or summaries. Paraphrasing and summarizing use many of the same skills, but they differ in their use of original material.

### **Paraphrasing**

Paraphrasing is rewriting a phrase, sentence, or section of text so that it reads differently but means the same. While paraphrasing, the vocabulary and the grammatical structure of the original sentence are recommended to be changed as much as possible. The new sentence structure and the vocabulary must distinguish the voice of the paraphrase from the original one so that it is not regarded as plagiarism. The paraphrase must also include the citation of the original source.

However, changing each word with a synonym and pasting the new vocabulary in a different order will not always produce natural sentences. This would be a too mechanistic approach to paraphrasing and it should not be practised as a mechanical exercise, or a word-for-word translation, but rather a natural rewriting.

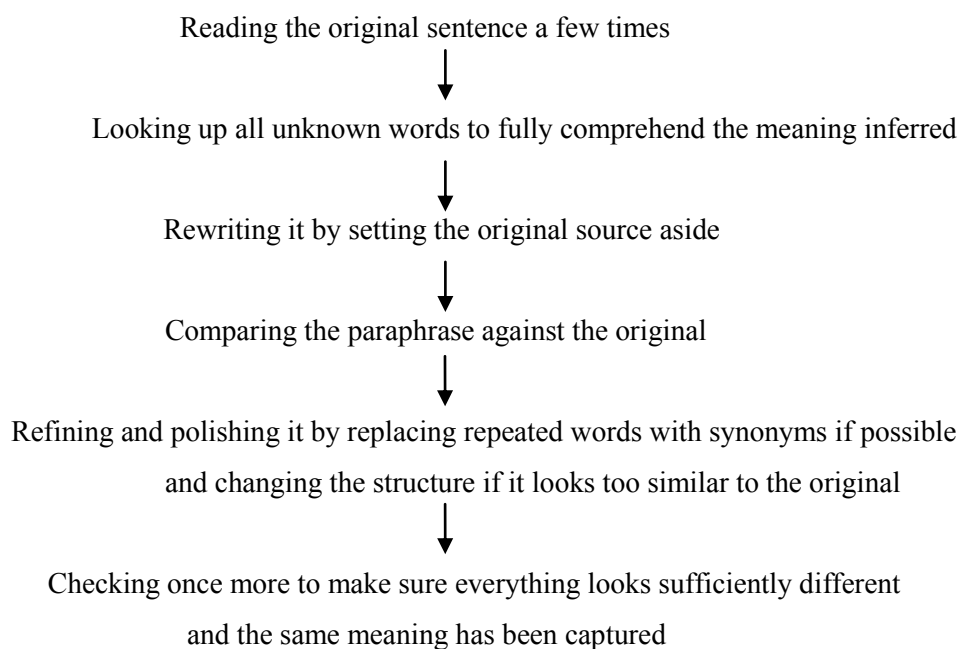
Before paraphrasing a sentence, it is important to first fully understand the original text very well. The first steps to paraphrasing are reading the original sentence a few times and looking up all unknown words until fully comprehending the meaning of the original sentence.

While rephrasing a sentence, the meaning of the original must be the main focus rather than its grammatical style. The new sentence should be written first, and later compared against the original to make sure the sentence structure and vocabulary have been changed and plagiarism has been avoided.

The paraphrase can then be refined by replacing the words with synonyms or different forms of words as much as possible. If the grammar is unintentionally produced in a very similar way, there are always various possibilities for changing it. Sometimes, methods such as inverting the sentence, combining short sentences into one long and complex sentence or splitting a long sentence into a few shorter and simpler sentences can be used. In the end, the write up must reflect the meaning expressed in the original source without plagiarizing its author.

When paraphrasing lengthy and complex source material, it is recommended to remove needless words from the text that may create verbosity in the rewriting and to include the essential thought in the original. In this process, taking notes while reading may be helpful. While paraphrasing, looking at these notes will ensure that all the necessary information in the original is included in the paraphrase and that unnecessary wordiness is avoided.

### **Basic steps of paraphrasing**



During the process of rewriting, the original vocabulary can usually be replaced by synonyms or antonyms. Sometimes, changing the form of the same word used in the source might be the only way to do it. However, some words are unique and cannot be changed without distorting the meaning. In such cases, one should stick with the original word rather than change the meaning for the sake of paraphrasing.

Generally, adjectives, adverbs and verbs are easier to replace with synonyms. However, most nouns are unique. Especially, nouns which define a concrete object (*such as “pipe, mirror, planet, salt, ocean, bottle, glass, cloud, milk, brain”*), and words that are technical or scientific terms (*such as “neutron, particle, triangle, cube, pesticides, quantum, genome, titanium, composites, ozone layer, global warming, fuzzy logic and black holes”*) should be kept and not changed; otherwise the meaning will be lost and the sentence will most probably sound inaccurate.

Sometimes, it may be necessary to expand phrases for clarification, and in some cases, it may be a wiser option to shorten long phrases for conciseness or totally eliminate them if they are redundant.

One does not necessarily have to find a synonym for each word in the original sentence. If the new word is the equivalent of the original word, or if it suggests the same meaning, it can be used; but if not, then retaining the meaning of the sentence is a priority and the original word should be kept.

The following example shows two possible paraphrases of an original sentence with their analysis.

**Original from Kurma Dasa's article on "Microvave Oven":**

Microwave exposure causes significant decreases in the nutritive value of foods.

**Possible paraphrases:**

1. Food that is exposed to microwaves will lose a considerable amount of its nutrients (Dasa, 2008, para. 2).
2. If food is heated or cooked in a microwave oven, it will lose an appreciable degree of its nutrients (Dasa, 2008, para. 2).

**Analysis:**

While rewriting the above sentence, in both paraphrases, the same meaning has been targeted with different wording and grammar as much as possible.

Regarding the grammatical structure, in the first sentence, a "relative clause" has been used. In the second sentence an "if clause" has been used.

Word-for-word rewriting is not applied. For example, in both paraphrases, there is no synonym used for the words "causes", "decrease" and "value".

While changing vocabulary, instead of "significant", "considerable" or "an appreciable degree of" has been used.

Instead of "nutritive value", a word which suggests a similar meaning is used: "nutrients".

In the first paraphrase, another form of the word "exposure" is used: "expose".

However, in the second paraphrase, instead of "microwave exposure", a totally different phrase, "microwave oven", is preferred and new verbs "heat" and "cook" are added to clarify the nature of the exposure. This is possible because a microwave oven is the only place where food is exposed to microwaves during heating or cooking.

## More paraphrase examples with analysis

The following paraphrase examples and their analysis show the scope of acceptable reinterpretation.

1. The information below taken from the article “Google targets Microsoft with launch of Chromebook laptop” by C. Arthur is a news report about a new type of computer planned by Google:

The Chromebook laptops will coordinate tightly with Google’s “cloud” online services, and have almost no capacity to store information; instead, the bare-bones operating system is essentially a web browser that steers users to applications like email and spreadsheets directly on the web, rather than storing software such as Outlook or Word directly on PCs.”

### Analysis

“Laptop” is a generic term, as is “operating system” but “cloud” and “bare-bones” may need some clarification. “Applications like...” and “software such as...” are very vague and really apply to all additional software over and above the OS. Additionally “applications” could be changed to “processing software”, but “apps” is also now an industry-standard term.

The *meaning* of the sentence is that the Google Chromebook will have very little memory, no software and users will need to be connected to Google’s Internet services to be able to use it properly.

### Possible paraphrase

Google’s laptop, the Chromebook, will only have a very basic operating system that allows the use of Google’s Internet-based applications instead of having software and storage installed on the device itself (Arthur, 2011, para. 3).

2. The information below taken from the article “Cryptosporidium Parvum” by G. Hannahs is about the dangers of impure water:

Current data is not adequate to advise all immunodeficient persons to boil or avoid tap water, but the risks involved are high enough that, until the health risk of drinking water containing small number of *Cryptosporidium* oocysts is clearly defined, it is advised that these individuals boil all water intended for drinking for at least one minute.”

### Analysis

“*Cryptosporidium*” is a type of parasite and an “oocyst” is its dormant (non-active) form, “oocyst” may not be needed depending on the topic of the research paper. The *meaning* of the sentence is that people who are “immunodeficient” (have no immune system, or one that does not work properly) are

especially at risk and should boil their drinking water to get rid of the parasites, even though there is not enough evidence to say that this is always necessary.

### **Possible paraphrase**

Because *Cryptosporidium* is thought to be especially dangerous to people who do not have an effective immune system, they should take care to thoroughly boil all of their drinking water unless this is proven unnecessary by further research (Hannahs, n.d., “Home Use”).

**3.** The next piece of information is taken from the article “Scientists Reject Link Between Nuclear Plants and Leukemia” by S. Connor, and is about childhood leukemia near nuclear power plants:

Childhood leukemia is a rare disease, affecting about 500 children each year in the UK. The scientists found just 20 cases between 1969 and 2004 among children living within 5 km of a nuclear power plant, and 430 cases of the disease in children living within 25 km.

### **Analysis**

In this case, the important information is the total number of cases of childhood leukaemia over time. If appropriate, a writer may decide to put 5 km and 25 km together under a common heading of “close to” (although “within 25 km” would also be acceptable) and may decide to put the total number of cases ( $20 + 430 = 450$ , between 1969 and 2004 = 35 years) together to match the 500 cases reported nationally each year “The scientists” do not need to be mentioned in the paraphrase because there is nothing in the original sentence to identify them. Mentioning that this is in the UK is important, as other countries and areas (such as Chernobyl) may have different results.

### **Possible paraphrase**

Although there are 500 cases of childhood leukaemia in the UK each year; over a 35-year period, a total of 450 cases have been reported in children who reside close to nuclear power plants (Connor, 2011, para. 7).

**4.** The following information from the article “The Human Genome and Our View of Ourselves” by S. Pääbo is about the Human Genome Project:

Large-scale comparisons of human genomes from many individuals are now possible with the emergence of high-throughput techniques for DNA sequence determination. The general picture already apparent from such studies is that the gene pool in Africa contains more variation than elsewhere, and that the genetic variation found outside of Africa represents only a subset of that found



within the African continent. From a genetic perspective, all humans are therefore Africans, either residing in Africa or in recent exile.

### **Analysis**

Here, the original source material is quite lengthy, but there are many things that can be removed depending on the topic of the research paper. For example “high-throughput techniques for DNA sequence determination” and “the genetic variation found outside of Africa represents only a subset of that found within the African continent” can be removed because they do not offer details, and may better be explained in a following paragraph. The important information is that DNA from many individuals has been compared, and the result is that all humans originally came from Africa, which still has the most variation of genetic types.

### **Possible paraphrase**

Wide-ranging comparative genetic studies have confirmed that humans originated from Africa, which remains the richest continent in terms of human genetic variation (Pääbo, 2001, para. 9).

**5.** The next piece of information from a newspaper article titled “Turkey’s Great Leap” by F. Gibbons and L. Moore is about the Turkish government’s hydroelectric projects:

Hundreds of private companies have been given extraordinary latitude to evict villagers, expropriate private land, clear state forests and steamroller normal planning restrictions to meet the target of 4,000 hydroelectric schemes by 2023. Protestors claim licenses have been granted on highly favorable terms, guaranteeing investors four decades of clear profit.”

### **Analysis**

Here, “evict”, “expropriate”, “clear” and “steamroller” are verbs that all have negative meanings in this sentence: it is explaining that villagers, landowners and forests are being removed by the government because they want to build 4000 hydroelectric plants on their land. “Protestors claim” means that what follows is claimed but not proven. It is important to mention that this is happening in Turkey, but Turkey is in the title, not in the original sentence. This information can be inserted either in the paraphrase, or can be mentioned in an introductory phrase or sentence before the paraphrase, depending on the context of the paragraph.

### **Possible paraphrase**

Regarding the situation in Turkey, Gibbons and Moore (2011) reported that there are claims of financial incentives to the private sector as well as the removal of legal protection from local communities and the environment in order to complete 4000 hydroelectric projects by the year 2023 (para. 9).

## Summarizing

As mentioned earlier, summaries, just like paraphrases, require the **complete rewriting of original sentences** from source material, and the same rules apply about **avoiding plagiarism** and **not changing the original meaning**. The difference between a paraphrase and a summary is that a summary usually involves a longer section of source material and simplifies it into a series of main points, whereas a paraphrase involves a closer rewriting and clarification of a shorter piece of text.

Of course, there is no clear point at which a paraphrase becomes a summary, or vice versa. Indeed, it is quite possible to cite one piece of source material that is partly summarized and partly paraphrased, as long as all the conditions (mentioned above in bold) are satisfied. In practice though, it is useful to think of paraphrasing and summarizing as two different techniques for getting the most out of source material.

Read R. Foeglar's article below and examine how it has been summarized.

### Mutation and Natural Selection

Natural selection is the means by which the organisms most suited to their environment succeed in passing their genes along to the next generation. If all the individual members of a species were exactly alike, natural selection could not occur as none of them would be more suited than the others. Natural selection requires that there are some differences between the individual members of a given population, and that at least some of these differences have a direct effect on the organisms' ability to survive and reproduce.

These necessary differences between individual members of the same species occur as a result of genetic mutation in their DNA sequences. Mutations may occur if the enzymes used to check an organism's DNA code fail or are corrupted in some way; the function of these enzymes can be understood by examining the rapid mutation rate of certain viral strains that do not have them. In addition, genetic corruption in one or both parental gametes in organisms that use sexual reproduction is also a cause of potentially mutated offspring. Mutations may also be caused by an organism's external environment, such as exposure to radiation or cosmic rays.

However, successful mutations are generally rare and have very small effect; most often they produce a minor alteration to an organism that is already capable of survival without them. Most mutations are known as micromutations: infinitesimally small changes that often do not confer any advantage whatsoever when taken in isolation, but which have a cumulative effect on succeeding generations. Additionally, as a vast majority of mutations are, in fact, harmful to the survival capability of the organism, these small changes are therefore much less likely to cause it to fail or become completely uncompetitive. Any variations that cause a negative change tend to be lost after a few generations due to the competitive disadvantage they confer, leaving only those that have produced a beneficial result.

From a survival point of view, micromutation is much more preferable to the alternative, macromutation: a huge genetic modification that in almost every case results in a creature far less suited to surviving in its environment than its non-mutated equivalent. Any large change to an already functioning organism could be said to be a dangerous exercise akin to a creature jumping off a cliff

and hoping to grow wings before hitting the ground. Natural selection does not favour large-scale mutations, a fact borne out by the scarcity of documented evidence to support them. These macromutations are generally one-off genetic accidents, and are usually reported as freaks of nature, as illustrated by the famous example of the frog born with its eyes in its mouth or the two-headed lamb. Such dramatic mutations seriously impair an individual organism's ability to survive and reproduce, and even clusters of such "freaks" often die out without their mutation having any bearing on the evolutionary progress of their species.

Although micromutations are, by definition, very slight changes, any mutation that confers the slightest advantage is naturally selected as that individual organism is therefore more capable of reproducing and passing its genetic code along to its offspring, which will also share its advantage and which will also be more successful at passing the mutation down through the generations until the mutation will eventually come to be the norm as it is now present throughout the entire population. To present natural selection in terms that can be more easily understood, it is common to give it personal traits and to say that it "favours" or "encourages", but this is not a perfect analysis. Natural selection is the process by which a slow, steady accumulation of advantageous changes ensures the success of those creatures that are best suited to their environment at the expense of those that are in competition with them.

## Analysis

The passage is quite long, but there are things that can be used, depending on the focus of the research paper. First, the topic is about how important mutation is to natural selection. In this case, the focus is on those parts of the passage that explain mutation. The writer may put the most important points into original sentences:

1. Natural selection depends on mutations that offer some advantage to the organism (para. 1, first line of para. 2).
2. Mutations can be caused by random factors such as radiation or wrongly-copied genetic code from the parent organism (para. 2).
3. Most mutations are harmful and are often quickly removed from the gene-pool (para. 3).
4. With very few exceptions, mutations are very small changes, and their effects are more of a minor difference in degree (para. 3-4).
5. Large "macromutations" are so infrequently successful that they cannot be said to have any effect on evolutionary changes within a species (para. 4).

At this point, a summary may be constructed. It may be that some points that are separated in the original would be better together in the summary. For example "Most mutations are harmful and are often quickly selected out of the gene-pool" and "Large "macromutations" are so infrequently successful that they cannot be said to have any effect on evolutionary changes within a species" both illustrate negative mutation and may be connected with a phrase or grammatical change.

## Possible summary

To summarize Foeglar (2011), natural selection depends on mutations that offer some advantage to the organism. These mutations can be caused by random factors such as radiation or wrongly-copied genetic code from the parent organism. With very few exceptions, mutations are very small changes, and their effects are more of a minor difference in degree. Most mutations are, however, harmful and are often quickly selected out of the gene-pool; this is particularly true of large “macromutations” that are so infrequently successful that they cannot be said to have any effect on the evolution of their species (“Mutation”).

## Quoting

Quotations are sentences taken word for word from an authority on the subject under discussion. When used efficiently and accurately, quotations can substantiate a person’s point of view. However, they should be used sparingly in the paper. Utmost care should be given when choosing a quotation. Not every sentence from a source will be worthy of being placed as a quotation in the paper. For effective use of a quotation, be sure to be selective on the basis of the significance of the content and vivid language. The quotation should fit in with the context, so the preceding and following sentences should be written carefully for the quotation to have meaning within the context it is used.

It is important to note that quoted sentences must retain the original words, punctuation and spelling. Generally a quotation is an exact copy of the original, but in some instances certain modifications may need to be made.

**1.** When quoting, sometimes writers may want to **eliminate parts of a sentence(s)** that are irrelevant to their argument, in which case use of an **ellipsis**, that is, **three dots** will be required and it is important to make sure that the remaining sentence is still grammatically correct.

### Example:

Original sentence: Lurking just behind your bathroom mirror, where all of your favorite beauty products are housed, is a virtual toxic nightmare.

Quotation with 3 spaced ellipsis: “Lurking just behind your bathroom mirror ... is a virtual toxic nightmare” (Connealy, 2006, para. 1).

In case of any omissions between 2 sentences, it will be clearer to use **4 dots**.

If the beginning or end of a sentence is omitted, use of ellipses is not a must.

2. If the sentence quoted is continued on the next page, the page break can be indicated by using a **slash (/)**.

**Example:**

“Whether or not Einstein’s / final research project, the nontrivial unification of physical theory, can be accomplished remains an open question” (Ballentine, 1972, pp. 1770-1771).

3. When needing to add information or make a comment within the quotation without altering the meaning of the original sentence, the extra information can be given in **square brackets [ ]**.

**Example:**

“When organic architecture [which encourages harmony between human surroundings and nature] is properly carried out no landscape is ever outraged by it but is always developed by it” (Wright quoted in Design Museum, n.d., para. 20).

4. **Non-English words** must be indicated either by italicizing or underlining.

**Example:**

Neuwirth (2004), perhaps controversially, states, “half the residents of Istanbul - perhaps six million people - dwell in *gecekondu* homes [poorly constructed illegal housing].” (p. 8).

5. If the sentence chosen as a quotation already appears as a quotation in the original source, this should be indicated by using **single quotation marks ( ‘ ’ )** within the double quotation marks.

**Example:**

“In his reply Einstein didn’t express any interest in the idea. He wrote, ‘I am as convinced as ever that the wave representation of matter is an incomplete representation of the state of affairs’ ...” (quoted in Ballentine, 1972, p. 1767).

6. A **reporting verb used in a short quotation** is followed by a comma. Do not use **“that”** after the reporting verb before a quotation.

**Example:**

Gates (quoted in Evers, 2004) remarked, “China and India are the big change engines for the years ahead, and as we embrace that and understand our role in that, that’s the path forward” (para. 2).

As expressed in the article “Economics” (2011, para. 1), “Economics is the study of opportunity. More specifically, economics is the study of the opportunities made possible by the transfer of goods and services.”

7. When quoting sentences that contain **more than 40 words**, a block quotation is used. A block quotation is prepared in a different way. The most distinctive feature is that no quotation marks are used with this type of quotation. The quotation begins on a new line, with a 2.5 cm (half an inch) indented (appearing in line with the beginning of a paragraph). Punctuation also differs. The block quotation is introduced with the reporting verb followed by a colon. The quotation ends with a period. After the period, two typewriter spaces are left, and the rest of the parenthetical documentation is added.

**Example:**

Global warming effects are beginning to be felt all around the world. Contrary to common belief that global warming will increase the temperature, which results in drought, erratic rainfalls in regions are major signs that things are starting to go wrong with the natural weather occurrences. As Al Gore (quoted in Reynolds) declared:

The heavy snowfalls this month have been used as fodder for ridicule by those who argue that global warming is a myth, yet scientists have long pointed out that warmer global temperatures have been increasing the rate of evaporation from the oceans, putting significantly more moisture into the atmosphere -- thus causing heavier downfalls of both rain and snow in particular regions, including the Northeastern United States. (n.d., para. 2)

It seems that the extreme amount of rain and snow that falls is a cause for concern. Not only drought, but also floods are going to be the alarming consequences of the change in climate

## **Putting it all together - Research writing in context**

Following the guidelines for **quotation**, **paraphrase** and **summary** will help develop the habits necessary for reliable research writing. However, the successful application of these skills will always depend upon context. This point is illustrated by the following two paragraphs, both taken from the same research paper:

### **Introductory Paragraph**

The scientific method continues to push back the frontiers of knowledge, allowing mankind to grasp the workings of the universe. Yet some fields of research seem particularly resistant to our best attempts at understanding. One such area is the origin of life on Earth. For a long time even the religious came to accept a notion of 'spontaneous generation', the idea that, for example, meat will spontaneously produce maggots if left for long enough. Of course, a few simple experiments (such as the isolation of meat from flies) proved this notion to be unscientific. In fact, it was not until Darwin

that someone dared to take a leap of imagination: **“But if (and oh! What a big if!) we could conceive in some warm little pond, with all sorts of ammonia and phosphoric salts, light, heat, electricity &c., present, that a proteine compound was chemically formed ready to undergo still more complex changes...”** (1888, “Letter to Hooker”). Of the many current hypotheses for the origin of life on Earth, the ‘Primordial Soup Theory’ continues to be a strong candidate, due to evidence from the famous 1929 experiment by Miller and Urey; its compatibility with the more recent “RNA World Theory”; and the paucity of material in support of alternative theories like the “Clay Theory”, Exogenesis and Panspermia.

### Analysis

This introductory paragraph only contains one piece of source material, a direct quotation. There are several reasons why the researcher decided to quote, and not paraphrase, this material. Firstly, it is a key definition of the main topic, the “Primordial Soup Theory”. Secondly, it is written in the conspiratorial style of a private letter, a less formal style than the rest of the paper, but ideal for a general introduction designed to capture a reader’s interest. Finally, it comes from one of the greatest scientists that ever lived (the word “proteine”, whose spelling has evolved into the modern “protein”, provides added historical detail that would have been lost if this excerpt had been paraphrased).

### Body Paragraph III.B

Another alternative hypothesis for the origin of life on Earth is “Exogenesis” which differs radically from the “Clay Theory”. To summarize Crookes (2008), **one version of this theory involves compounds called nucleobases, the building blocks of genetic material, being imported from space by meteorites. Analysis of meteorite samples revealed that the nucleobases Uracil and Xanthine were composed of the carbon isotopes signifying an extra-terrestrial origin. This evidence, plus the fact that the planet received heavy meteorite bombardment around 4 billion years ago, lends support to the idea that life on Earth may have been “seeded” from Space** (p. 14). The difficulty of accounting for the first appearance of life on Earth is nicely side-stepped by this theory; though it could equally be said that it merely defers the problem to some more remote origin. Most scientists still believe the vast majority of organic compounds, including nucleobases, were probably produced on Earth itself. As Conel Alexander, a meteorite scientist from the Carnegie Institution in Washington comments, **full understanding of the relative amounts of molecules and of their origins is still lacking, so it would be unwise to jump to conclusions based on the small additions that meteorites may have made to the chemistry of the Earth** (cited in Minkel, 2008, para. 11). It seems that it is still too early to say with any assurance whether or not the complexity of life on Earth required the assistance of extra-terrestrial chemical compounds in order to get started.

## Analysis

The first citation of source material is a **summary**, simplifying into a few sentences the main points taken from paragraphs 2-5 of the source below:

### Life from Space

One of the great debates in science is just how life on earth began. Most scientists believe that the earliest living things utilized organic compounds created by reactions in the environment of the early Earth. However, the appearance of compounds such as nucleobases, which combine with sugars to form the basis of nucleic acids, is harder to explain. Laboratory experiments to create the conditions for their development are yet to prove conclusive.

It is for this reason that scientists are beginning to take more seriously the hypothesis that certain organic compounds may have arrived on our planet ready-made. The theory is that they were contained in the rock of meteorite showers that at one time peppered the earth's surface and 'seeded' the life which eventually evolved into you and I.

This may seem hard to believe at first, but recent evidence has made the theory a lot more scientifically plausible. Two meteorites that hit Antarctica in the 1990s turned out to be CR chondrites, pieces of asteroids that would have formed at the beginning of the solar system itself. These mind-bogglingly ancient pieces of extra-terrestrial rock have been found to contain organic compounds in concentrations of 180 to 249 parts per million. What's more, these compounds include crucial nucleobases, the building blocks of RNA and DNA.

Scientists involved in the research on the rare rock samples were anxious to pre-empt the criticism of skeptics so they analysed the ratio of carbon isotopes in the Xanthine and Uracil nucleobases found in the meteorites. As hoped, the analysis showed a high ratio of extra-terrestrial Carbon 13 in the two nucleobases, confirming their origination in Space.

Astrophysicists believe that the Earth received heavy bombardment from meteorites 3.8 to 4.5 billion years ago, which on a geological timescale is only just before the appearance of the first lifeforms. It has been calculated that something in the order of tons of carbon would have been delivered to the surface of the planet each year during this bombardment. While nobody is claiming that meteorites were the only source of organic compounds on the early Earth, the case for their role in helping to 'seed' life on Earth remains a tantalising possibility.

The researcher has decided to summarize this article because the aim is to explain briefly some of the recent evidence for Exogenesis without getting involved in too much technical detail. The focus of the paper, as can be seen from the thesis statement, is not Exogenesis but the 'Primordial Soup Theory'. This body paragraph therefore deals with a side issue. If the central thesis of the research paper involved a detailed examination of Exogenesis itself, then the researcher would probably have chosen to paraphrase the relevant technical details of this source (and those of many other more specific sources related to the theory of Exogenesis) in developing that particular thesis.



On the other hand, the researcher did decide to **paraphrase** the following source excerpt from J. R. Minkel.

**Were Meteorites the Origin of Life on Earth?**

Conel Alexander, a geochemist at the Carnegie Institution of Washington who specializes in meteorites, says that without more data, claims about the amounts and sources of molecules on early Earth should be taken with a grain of salt. “It really comes down to quantitative arguments about how much was made on Earth [and] how much was brought in from space,” he says. “Any honest person would keep an open mind about the whole issue.”

The focus here is on the fact that an authority in the field is skeptical or dismissive of the Exogenesis theory. As stated in the thesis statement, the researcher is showing that alternatives to the “Primordial Soup Theory” lack sufficient data and do not have wide support within the scientific community. This excerpt is therefore the main point of the whole paragraph and so deserves to be paraphrased.

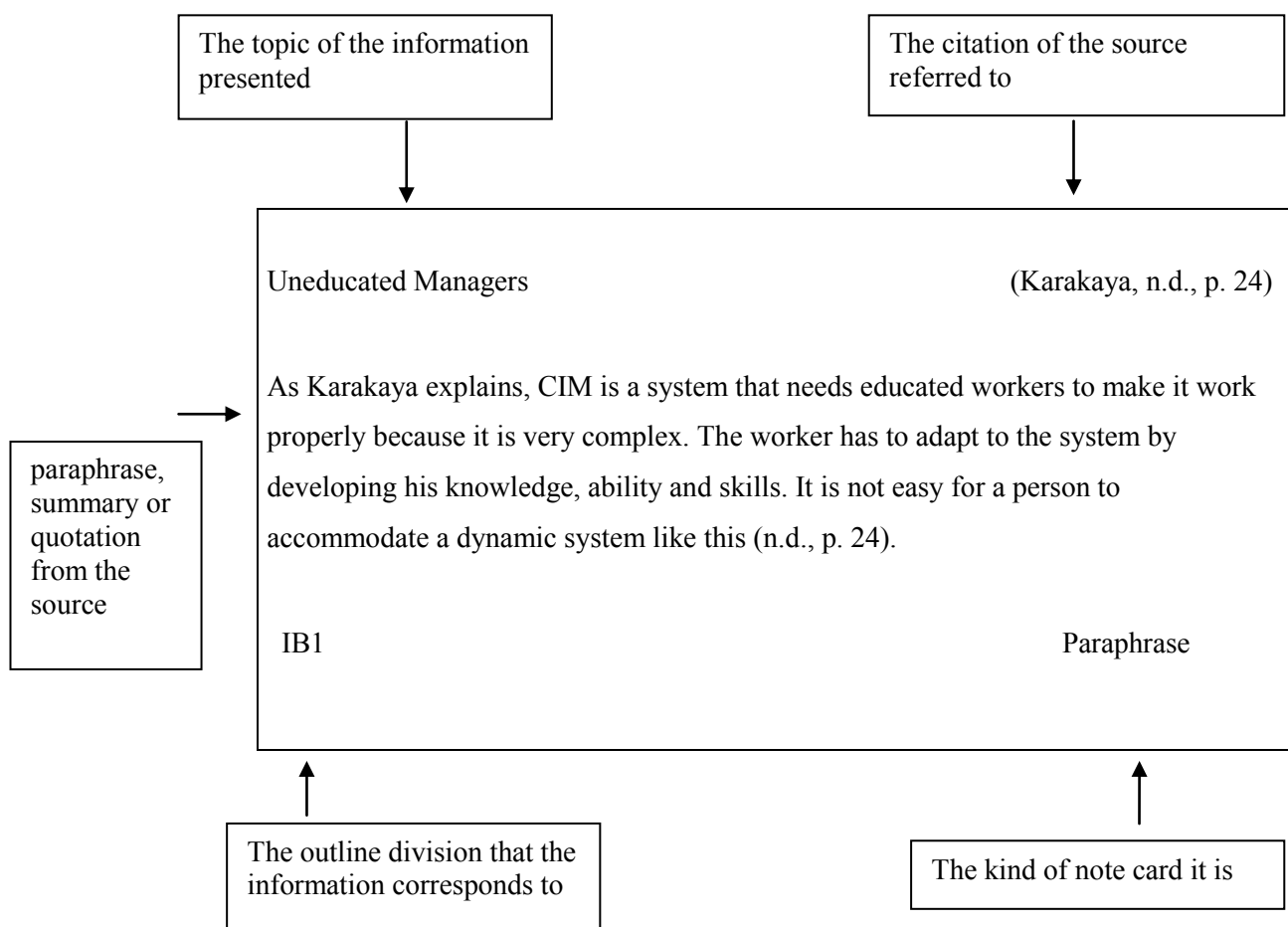
Therefore it can be seen that the choice of rewriting technique for the source material in the paragraphs above depends on **context**. In other words, the decision to use **paraphrase**, **summary** or **quotation** will depend on the topic being researched, the approach taken in the thesis statement, the type of source material being used and the purpose of a particular paragraph.

## Preparing note cards

While reading sources, for the purpose of organization and time efficiency, it can be practical to write on note cards which will help during the note taking process. This procedure will aid writers in organizing the information they will be using from the sources.

To make the location of information clear and easy, notecards should be laid out as follows:

### Example of a note card:



## In-text citations

### Clarifying the parts cited

The in-text citation is made up of **3 units**. If you are citing only **one sentence** that has been paraphrased, summarized or quoted, the in-text citation can be given at the end of the source information. See the samples below.

The number of American people speaking on mobile phones was four times more than the equivalent number for Europe (Zaher, 2008, p. 1).

“An American cell phone subscriber averages 833 minutes (outbound and inbound), whereas in Europe, average consumption ... totaled a mere 176 minutes, with Finnish consumption totaling an average 315 mn/habitant/month” (Zaher, 2008, p. 1).

However, if the source information you are using is a paraphrase or summary of **more than one sentence**, one or two units of the citation should be given before the source information starts and the rest after the source information ends.

As Zaher stated, the number of American people speaking on mobile phones was fourfold compared to the number for Europe. The surprising fact is that, despite this huge difference of mobile phone usage, the number of Europeans owning a mobile phone was higher than that of Americans with a mobile phone (2008, p. 1).

Here, the writer, as the first unit of citation, is given at the beginning, and the remaining two units are given at the end. As an alternative, the first two units can be mentioned at the beginning, leaving the last unit of citation at the end, as in the example below.

As Zaher stated in 2008, the number of American people speaking on mobile phones was fourfold compared to the number for Europe. The surprising fact is that, despite this huge difference of mobile phone usage, the number of Europeans owning a mobile phone was higher than that of Americans with a mobile phone (p. 1).

Let's examine the problems in the citations below:

The availability of wave energy is 80 to 90 percent of the time while wind varies between 30-45 percent, changing according to the place. Moreover, the predictability of wave energy is higher than that of the wind (KOHD TV Station, 2008, para. 5).

In this example, the in-text citation placed at the end of the second sentence is misleading, as the first sentence which also comes from the same source has not been cited.

According to the news report of KOHD TV Station on their website (2008, para. 5), the availability of the waves is 80 to 90 percent of the time while the availability of the wind varies between 30-45 percent, changing according to the place. Moreover, the predictability of wave energy is higher than that of the wind.

The in-text citation in this example is also erroneous, because now the second sentence, which is paraphrased from the same source, is not cited.

The correct citation of the above sentence should read:

According to the news report of KOHD TV Station on their website, wave energy is available 80 to 90 percent of the time while wind varies between 30-45 percent, changing according to the place. Moreover, the predictability of wave energy is higher than that of the wind (2008, para. 5).

If there are **multiple pages** involved, clarification can be made in the following way:

As Murray (2009) reported, after the Chernobyl accident, 203 operators working in the plant, firefighters and emergency staff were contaminated by radiation and had to have hospital treatment. However, 31 of those people did not survive (p. 310). A great many people were moved to safer places, which caused a lot of expense and suffering (p. 311).

### Using reporting verbs

When reporting the findings of other people's work in the paper, writers must use certain verbs to show the relevance of that information to the work and to reinforce their argument. The choice and correct usage of verbs when referring to or citing sources in the text are of great importance.

The selection of a reporting verb should be made by taking into consideration two main points:

- **The meaning of the verb:** Some verbs may have a more neutral connotation whereas others may contain stronger implications. The choice should be made according to the information being presented.
- **The grammatical structure:** Depending on the verb, the structures that follow it will differ. Some words may need to be followed by a preposition, some may need to be followed by an object or some can be directly followed by "that".

**Here is a list of most commonly used reporting verbs and examples that show the grammatical structures that follow them.**

add	define	focus	predict
advise	demonstrate	highlight	present
analyze	describe	illustrate	propose
argue	discover	indicate	prove
assert	discuss	inform	recommend
claim	emphasize	investigate	remark
comment	estimate	list	report
compare	evaluate	maintain	state
conclude	examine	mention	suggest
contend	exemplify	note	tell
criticize	explain	oppose	warn
declare	find	point out	write

1. **Some verbs are directly followed by a ‘that’ clause.** The verbs “argue”, “assert”, “add”, “advise”, “claim”, “conclude”, “declare”, “discuss”, “emphasize”, “explain”, “find”, “indicate”, “maintain”, “mention”, “note”, “point out”, “recommend”, “remark”, “report”, “show”, “state”, “suggest”, “warn” and “write” are some common examples of such verbs.
  - Dawkins (2004) **argues/asserts/discusses** that science alone cannot determine what counts as ethical and what does not, but that it can, for example, show how a clone like “Dolly” is no different from an identical twin (p. 39).
  - Wilson **explained/reported that** harvesting rainwater and using the refined greywater decreased water consumption, which, in turn, provided significant economic advantages (2005, para. 12).
  - Nicholson (1991) **pointed out/stated that** in manufacturing, there are problems that occur because of the difficulty of new technologies and employees cannot control and solve the problems since there is lack of knowledge about CIM (pp. 133-135).
2. **Apart from their use with “that”, some verbs can also be used with a preposition if they are to be followed by a noun.** The verbs “warn” and “write” can be given as examples.
  - With the conclusions of his study, Hertel **warned of** the changes in the structure of the blood that could occur, leading to the weakening of the body when heated by microwaves (cited in Seiler, 2005, “Research Results”).
  - Ching **wrote about** the increase in the use of pesticides (2004).

**3. Apart from their use with “that”, some verbs can be followed by a gerund (verb+ing).**

The verbs “advise”, “recommend” and “suggest” are some examples.

- Cosgriff Dunn (2008) **advised/recommended/suggested constructing** rain gardens or wetlands as an economical solution for collecting stormwater runoff and biofiltering it to get rid of pollutants (“Stormwater,” para. 4).

**4. Besides their use with “that”, some verbs can be followed by a noun phrase or subjunctive.**

Verbs such as “demonstrate”, “explain” and “show” are some examples.

- USDE **demonstrates/explains/shows how** a wind turbine works through the use of an animation, stating that the wind possesses the energy to turn the blades of the turbine placed around a rotor, and the rotor, which is attached to the central shaft, causes the generator to revolve, making it produce electricity (n.d., “Animation”).

**5. Some verbs are directly followed by an object, which could be a pronoun, a noun or a noun clause. The most common verbs used as such are “analyze”, “compare”, “define”, “evaluate”, “examine”, “exemplify”, “highlight”, “illustrate”, “investigate”, “list”, “oppose” and “present”.**

- Hobsbawm, in his book *Age of Extremes* (1994), **analyzes** the twentieth century as having a meaningful historical unity only when viewed from 1914 to 1991, a period which he calls "The Short Twentieth Century".
- Cohen **compared** exposure to radiation from nuclear energy with natural radiation that people are exposed to every day in terms of the chances of having cancer and showed that exposure to natural radiation, which is 0.2%, may cause a cancer risk of 1% whereas exposure to nuclear technology increases people’s risk of having cancer by only 0.002% (n.d., para. 3).
- The Genetic Science Learning Center **defines** cloning as, “The creation of an organism that is an exact genetic copy of another” (2010, para. 3).
- Cancer Research UK **examined** the studies made on the link between mobile phones and cancer only to find that humanity has neither proved nor disproved the relation between the two (n.d.,

para. 1).

- Job states that gasoline-electric hybrid vehicles are much more expensive than non-hybrid vehicles as **exemplified** by comparing a Honda Civic Hybrid's \$4,800 price difference over that of a Civic LX (n.d., para. 11-12).
- Derene **evaluated** the performance tests of iMac applications like the internet browser, Microsoft Word and Adobe Photoshop and concluded that they started considerably faster than an equivalent Gateway One PC (2008, "Speed Test").
- "The Global Warming Effects Interactive Map" **illustrates** how various areas around the world will be affected by the persistent alterations in weather patterns (n.d.).
- Whitlock, a fossil pollen expert, (cited in Morell) **investigated** clues retrieved from nature to shed light upon the patterns of climate changes that the world has experienced over centuries (2010, para. 4).
- The IEA **lists** the environmental benefits of hybrid electric vehicles as a fifty percent decrease in harmful pollutants and greenhouse gases, conservation of energy, and the ability to utilize environmentally-friendly fuels (n.d., "Outlook," para. 4).
- Cancer Research UK **highlighted** the fact that the only health risk of mobile phone usage that has been proven is "car accidents" as the driver's attention is diverted while using it (even though a hands-free kit may be used), increasing the chances of having an accident fourfold (n.d., "Health Risk").
- M. Lüsted and G. Lüsted **highlights** the importance of nuclear power plants in producing energy by stating that 17% of the global electricity need and 20% of the electricity need of the USA is provided by nuclear power plants in a much more efficient way than it would if it were produced by other energy sources (2005, p. 13).
- Gethmann and Thiele **opposed** the ban on reproductive cloning in their thesis, *Moral Arguments Against the Cloning of Humans*, by claiming that they are hypothetical rather than apodictic (2001, Abstract).
- Almirall and Sachon **present** the potential applications of RFID technology, one being its use in the consumer's home, such as intelligent refrigerators controlling their own inventory (n.d., "Key Messages").

**6. Some verbs are followed by a preposition.** When using such verbs, make sure you use the correct preposition after them.

- Chattopadhyay **commented on** the functionality of smart jackets that have got a pulse monitor and can automatically activate functions such as heating and lighting according to environmental conditions (2006, p. 24).
- Karakaya **focuses on** the necessity of a communication system within a CIM system (n.d., p. 24).

### **Format rules on using reporting verbs**

While using reporting verbs, writers should also be careful about the use of **“that”** and employ correct **punctuation**.

**1. Use “that” in paraphrases or summaries** after the reporting verb.

- **Morris stated that** many countries in the world are making use of nuclear energy and they would not do so if nuclear posed a great threat to humanity (2000, p. 26).

**2. Do not use “that” after the reporting verb if a sentence begins with “As” or “According to”.**  
Instead, use use a **“comma”**.

- **As Morris explained,** there were no casualties at Three Mile Island; nobody had radiation sickness, however the anti-nuclear power activists still acted as if the accident was a life-threatening one and protested against it (2000, p. 25).
- **According to Morris,** there are a number of indications showing that the decision to bring to a halt the developments in the nuclear power sector was the result of poor reasoning (2000, p. 26).

**3. Use a “comma” after the reporting verb in quotations.**

- **Morris pointed out,** “In 1979, when a loss of coolant accident occurred at a nuclear power plant at three Mile Island, in Pennsylvania, the stage was set and the event became front page news for almost six weeks” (2000, p. 25).

**3. In the parenthetical documentation, the symbol “&” is used between two authors; however, you should write the word “and” if using the writers outside the parenthesis with a reporting verb.**



- In the past, the wind turbines were usually functioning at a regular speed; however, in recent years, more and more wind turbines with varying speed are being produced and installed (Muljadi & Butterfield, 2000, p. 1).
- Muljadi **and** Butterfield state that in the past, the wind turbines were usually functioning at a regular speed; however, in recent years, more and more wind turbines with varying speed are being produced and installed (2000, p. 1).

5. If there is **indirect information in the source**, then use a reporting verb in the following or similar ways:

**Writer of the indirect information:** Kaplan    **Writer of the source:** Liss

**Kaplan (as cited in Liss, 1986) stated that** before applying CIM, the time spent for processing in Yamazaki Machinery Company was 35 days whereas on average, it is less than one day now (p. 60).

**Liss (1986) is cited in Kaplan as stating that** before applying CIM, the time spent for processing in Yamazaki Machinery Company was 35 days whereas on average, it is less than one day now (p. 60).

6. The tables and figures are placed after the “References” page. See pages 115-120 to learn how to incorporate tables and figures into the paper properly.

When using **tables or figures** in a research paper, it is necessary to refer to them in the text. While referring to tables or figures, a format similar to the ones below can be utilized.

- The weight of an aluminum hull structure is nearly 35% to 45% less than that of the same hull made of steel (**See Table 1**).
- **As can be seen in Table 1**, the weight of an aluminum hull structure is nearly 35% to 45% less than that of the same hull made of steel.

7. If titles of sources in which an article appears are mentioned in the text, these **titles such as books, magazines, journals and encyclopedias** are written **in italics and capital letters**.

- As explained in Gunasekaran’s article published in the *International Journal of Computer Integrated Manufacturing*, “One of the biggest obstacles to CIM implementation is that systems

are conceived by corporate headquarters and then pushed down onto a plant manager” (1997, p. 273).

8. Letters, interviews, telephone conversations and e-mails are some examples of **personal communication**. When making use of personal communications in a paper, they need to be cited in the text, but they are not entered into the “References” as their retrieval by someone else is not possible. The in-text citation of a **personal communication** can be done by giving the **initials, as well as the surname of the person and an exact date**.

- E. Van Heerden (personal communication, May 10, 2011) said that the majority of buildings are designed by the use of 3-D design tools today.

### **Varieties of reporting source information**

The sample sentences below show in how many different ways source information can be cited.

- Usage of CIM reduces the time that is consumed during the production phases of manufacturing (**Schröder, 1986, p. 4**).
- **Jestin (2007) explains** that Six-Sigma is a very reliable method of removing many of the problems within a manufacturing system (**para. 1**).
- **Shaukat and McArthur indicated that** producers from North Africa like Algeria and Libya as well as middle eastern countries like Iraq and Iran, have the possibility to be Europe’s future gas suppliers if political problems are handled (**2009, p. 32**).
- **As research by the World Fair Trade Organization [WFTO] shows**, in order to acquire a proper working environment, there are fair trading terms defining salary conditions, forbidding too long working hours and not permitting the seasonal circumstances to have an impact on the manufacturers (**2009, p. 1**).
- **As emphasized by Lapsa et al. (2007, pp. 14-16)**, with solar lighting systems, there is approximately a 6000 kWh saving in energy per year.
- **According to Mateus cited in Mateus and Oliveira (2009, pp. 949, 955)**, the usage of solar energy in buildings is the best way to prevent harmful emissions like CO<sub>2</sub> and fossil fuel consumption.

- **As emphasized in the article “Tidal Power” (n.d., “Introduction”, para. 1)**, the life of the plant is indefinite and for its entire life it will receive free fuel from the tide.
- **Hobsbawm**, in his book *Age of Extremes* (1994), **analyzes** the twentieth century as having a meaningful historical unity only when viewed from 1914 to 1991, a period which he calls "The Short Twentieth Century".

## Interpreting and commenting on source information

The most important aspect of the research paper is the *originality* that the writer brings to it. Originality is obtained through combining personal inferences, conclusions and interpretations with the research findings acquired from scholarly sources. A paper that is based only on a collection of information from a list of sources will definitely lack originality. Each piece of information integrated in the paragraph should first be critically examined, analyzed and evaluated for a constructive personal *conclusion* to be drawn, and *deductions* to be made. It must be noted that comments are used for the purpose of presenting original ideas and observations from the information produced as evidence. They can also take the form of *predictions*, *advice*, *warning* and *emphasis*.

Any new information that is not substantiated by a research finding will not constitute an acceptable comment.

## Transition signals and opening phrases for personal comments

Transition and connection between source information and comments will make the paper more fluent. Examine the following sentences to see in how many different ways they can be related to the source information.

- **Clearly/Obviously**, these advantages of wind turbines lower the costs of electricity production.
- **This surely explains that** microwaves increase the feasibility of the balloon angioplasty, which is a safer alternative to more dangerous cardiac surgeries.
- **From the examples given above, it is clear that** ionizing radiation may increase cancer rates.
- **As indicated above, it can be argued that** people can understand the mystery of mind and DNA through quantum theory.
- **In view of this information, it can be claimed that** squares are important elements of city design that allow people to socialize.

- **On account of all these facts, it can be said that** the efficiency of the BMW engine provides a satisfying driving experience for the owners.
- **Taking all these facts into account, it is clear that** this property of hydrogen energy will surely be useful in many applications.
- **For this reason,** only countries which receive the sun for longer periods of time will make use of solar energy efficiently.
- **Therefore,** employee satisfaction can be considered as an important factor for a motivated and productive work force.
- **Thus, it is obvious that** there is a direct relationship between mental health and the built environment.
- **Objectively speaking, one cannot deny the fact that** maintenance for Maglev trains is easier than traditional trains, because there are fewer parts to repair and examine.
- **Taking this into consideration, one can conclude that** navigation with GPS is practical and reliable.
- **This implies that** people who are fired or can not find a job for a long time may have a tendency to commit domestic violence.
- **Considering the information above, it can be said that** China is the most favorable investment zone at present.
- **This shows that** desalinization should be considered as the best alternative to produce drinking water.
- **This makes it clear that** geothermal energy use may increase if these problems are solved.
- **Taking all these facts into consideration, it is possible to claim that** people who had high expectations while leaving their homeland may very well end up living in the same miserable conditions in the country to which have they migrated.
- **All these examples show that** worldwide search possibility of online shopping makes the process of purchasing goods easier and more efficient.
- **In the light of all these facts, it is undeniable that** ocean energy offers sustainability.

## Different ways of making comments

1. The following information and comment are about the impact of Persistent Organic Pollutants (POPs) on marine mammal population.

**Paraphrased information:** The SeaWeb Organization lists the probable impacts of POPs on marine mammal population as decreased fertility, increased reproductive failure and birth defects. These chemical pollutants trigger stress and make it nearly impossible for an animal to adapt to the altering environmental conditions (n.d., “The Causes,” para. 2). In addition, Calder makes a point of saying that marine mammals' reproductive systems are negatively affected as a result of chemical obstruction of their hormones. To give an example, the occurrence of contamination in mammals disrupts the estrogen receptor, thus hindering reproduction (n.d., “Broad Attack on Reproduction”).

**Comment:** In view of all this information, it can be deduced that the adverse effects of chemicals on the reproductive system of arctic mammals are leading to serious global consequences such as disrupting the course of nature by contributing to the extinction of certain species. By compromising the health of these animals, POPs will inevitably incur more pervasive damage by causing a disturbance in the natural food chain. The application of POPs should definitely be restricted and measures must be taken to avoid the widespread atmospheric transport of such chemicals.

The above comment comprises a **deduction** drawn from the main idea, a **future prediction** and finally **advice** for the avoidance of the use of POP's.

2. The following information and comment are on the use of Nanotech Textiles.

**Paraphrased information:** Elvin explained the function of the newly found method of producing antibacterial fabrics. Hybrid materials produced by the attachment of porous membranes to halamides which are polymer molecules that act like a disinfectant in combating bacteria will be applied to fabrics as a coating, thus confining and eliminating bacteria. Such clothes worn by soldiers, farmers, medical doctors, nurses and patients will have absolute defense against bacteria, resulting in the safety of the wearers against infections (2006).

**Comment:** Clearly, the search for solutions to battle with harmful external bodies has finally led to some very practical and functional applications of nanotechnology. It is clear that those textiles with inbuilt bacteria proof properties eradicate inconveniences such as having to find and apply complex methods to fight off bacteria. People working in environments where they may be vulnerable in terms of health would benefit from the bacteria proof quality of nanotech textiles and be safeguarded against

the negative effects that bacteria can create in a convenient way. The use of such protective textiles could be extended to other areas of daily life, especially where children are involved.

The above comment comprises an **emphasis** of the main idea to strengthen the implications, a **deduction** for a conclusive remark and finally a **suggestion** for the application of nanotech textiles in other fields.

**3.** The following is information and the comment are on Green Buildings.

**Paraphrased information:** According to US EPA's comments, city buildings become warmer (up to 50 degrees Centigrade more) than the temperature of the air on sunny summer days and after daytime the temperature in the city remains higher than the non-urbanized regions, so this causes the heat island effect (2009, para. 1). As Bell et al. indicate, the temperature of a city could be reduced by 0.8 degrees with the utilization of green roofs only and an even further reduction of 2 degrees could be possible with extra watering facilities on the roof tops according to a sample study done on half of the buildings in Toronto. Also, a study conducted in Chicago, comparing the surface temperature of a green roof in mid August with that of a regular building's roof showed that there the green roof surface was between 33 to 48 degrees, whereas the normal roof was 76 degrees centigrade (n.d., p. 3).

**Comment:** Considering the information above, it can be said that in big cities, where there is more and more of a tendency towards constructing high rise buildings in proximity, there is more likelihood of suffering the consequences of the heat island effect. As these tall structures are so close to each other, there is less room for air to circulate and with this, an escalation in temperatures is unavoidable. Especially in the summer, with temperatures rising, and on occasions, exceeding normal seasonal limits, there will be nowhere to escape for a breath of fresh air. This will in effect result in more of a dependency on air conditioners which contribute to global warming. Therefore, governments should encourage the green building concept so as to lessen the heat impact on cities by shielding the buildings from the scorching sun.

The comment made above consists of a **deduction**, a **prediction**, a **warning** and finally some **advice**.

## **Preparing concluding sentences**

The last significant unit of a paragraph is the concluding sentence. It is the final statement that signals the end of a paragraph. The concluding sentence restates the main points mentioned in the paragraph. Rewording the topic sentence is one way of writing a concluding sentence. Another way is to summarize the main points by briefly recapturing what was mentioned in the research findings. One thing to avoid is producing new information in the concluding sentence that was not discussed in the paragraph.

**The following examples show how the topic sentences have been rephrased to make up the concluding sentences.**

### **Example 1:**

**A.** Advantages of using GPS during disasters

#### **Topic sentence for A:**

To begin with, GPS offers various advantages when used in disaster relief.

#### **Concluding sentence for A:**

All things considered, the benefits of using GPS in disaster relief are unquestionable as it helps to decrease human loss by increasing the efficiency of rescue operations.

### **Example 2:**

**A.** Effects of electric vehicles in decreasing air pollution

#### **Topic sentence for A:**

Primarily, electric vehicles help to decrease air pollution resulting from harmful emissions.

#### **Concluding sentence for A:**

All in all, it can safely be said that using electric vehicles results in air pollution reduction as they do not emit harmful gases.

### **Example 3:**

**A.** Time efficiency of CIM

#### **Topic sentence for A:**

Above all, time efficiency is gained with computer integrated manufacturing by reducing both cycle time and lead time.

#### **Concluding sentence for A:**

Research thus shows that with CIM systems, a lot of time is saved that would otherwise be wasted, which is unquestionably beneficial for companies.

**Example 4:**

**A.** Low labour cost in China

**Topic sentence for A:**

First and foremost, low labor cost in China leads to cheap production.

**Concluding sentence for A:**

It can be concluded that the huge labour resources in China cause a decrease in the payment offered for labor, which makes the production of many goods cheaper than can be achieved elsewhere in the world.

**The following sentences show how the main points mentioned in the supporting sentences have been summarized to form the concluding sentence.**

**Example 5:**

**B.** Working environment quality

**Topic sentence for B:**

A further advantage of CIM is the fact that the quality of the environment is also raised by its use.

**Subtopic sentences for B:**

1. One of the ways how this is achieved is through increasing the workers' convenience,
2. Another way to boost the quality of the environment is to provide maximum worker safety.

**Concluding sentence for B:**

Consequently, through the further development of quality, the work environment is made to be more convenient and much safer for the workers to work in.

**Example 6:**

**A.** Environmentally-friendly feature of green buildings

**Topic sentence for A:**

First of all, green buildings are compatible with nature.

**Subtopic sentences for A:**

1. For example, there is less urban heat impact.
2. Moreover, there is a reduction in construction waste.

**Concluding sentence for A:**

To conclude, with lesser amounts of waste left over from building sites, and not as much urban heat effect, green buildings undoubtedly ensure the preservation of the environment.



## **Suggested phrases and signal words for starting a concluding sentence**

Examine the following sentences for a variety of signal words and phrases that can be used to start the concluding sentences of a paragraph.

- **As a result, it can be concluded that** the abundant work force in China results in very cheap production.
- **Consequently, the security benefits of** using GPS in tracking **are obvious.**
- **All things considered,** not only its long service life but also its low maintenance and operation costs make wind power a preferable alternative from the economic aspect.
- **It is obvious from the above that** concrete roads have better weather and abrasion resistance compared to asphalt roads, which results in a longer service life with less maintenance requirement.
- **All in all, it can safely be said that** price setting is one of the most crucial steps in the sales process.
- **All these examples prove that** using RFID chips to avoid thefts and loss leads to significant economic benefits.
- **Clearly,** their huge capacity for the passengers and the cargo makes catamarans a popular naval transportation vehicle.
- **Research thus shows that** correct and appropriate material usage and design are significant factors to produce ergonomic products for users.
- **It can be concluded that** tax deductions and free parking opportunities provide encouragement for people who consider buying a hybrid car.
- **For all these reasons,** brain drain should be considered as a great economic loss for a country.
- **In short, the positive impacts** of forensic chemistry on the investigation of the crime scene **are undeniable.**
- **In brief, it is obvious that** the stabilization of water with the construction of dams provides water for not only domestic use but also for industrial and agricultural use.
- **Therefore,** hydrogen has the potential to become a very important alternative energy source in the future.

## **Sample paragraphs**

### **Outline division for A & B paragraphs of the paper about “Green Buildings”**

#### The Benefits of Green Buildings

Thesis: Green buildings are becoming increasingly popular as they offer efficiency and economy besides being environmentally-friendly.

#### I. Efficiency

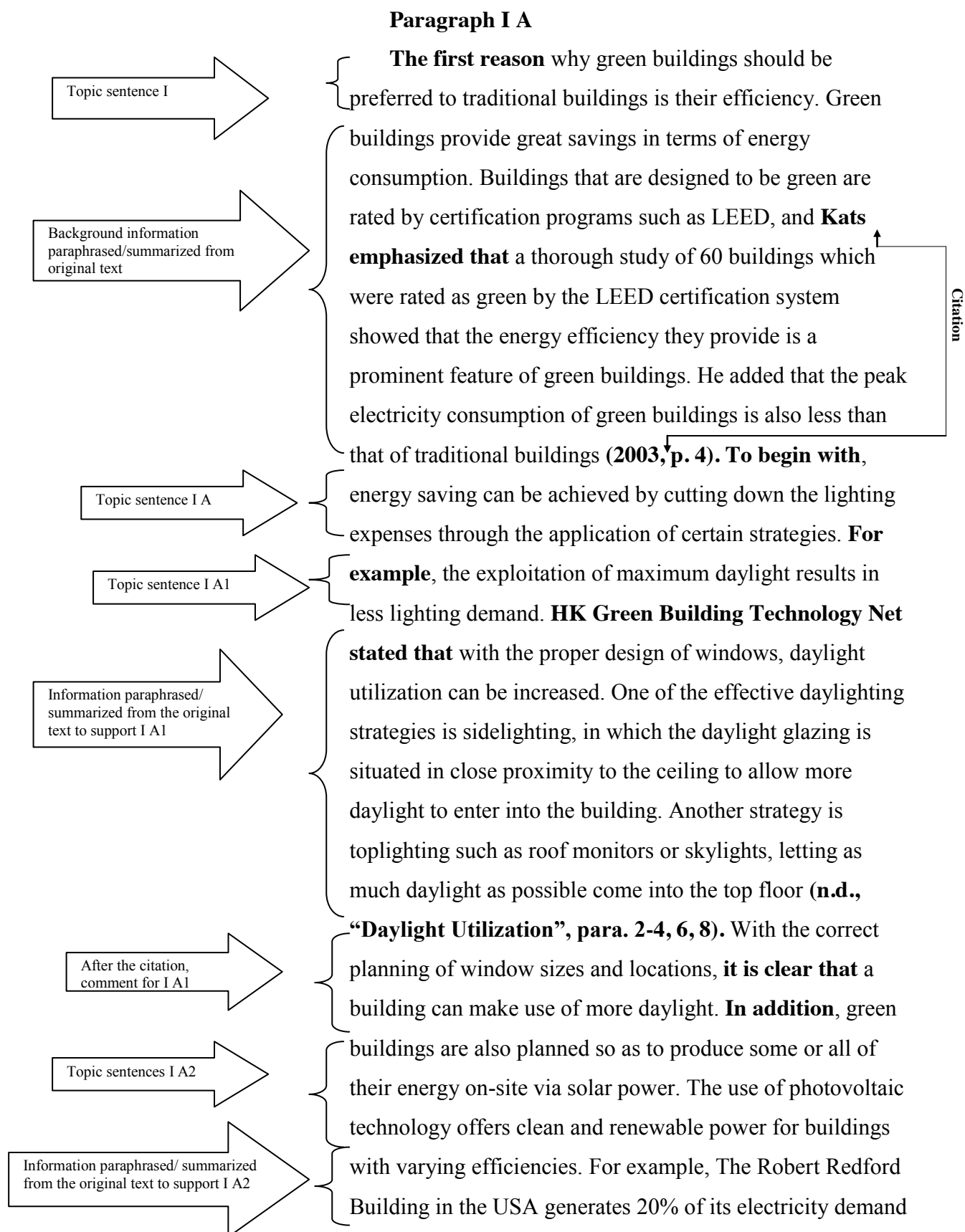
##### A. Reduced lighting expenses

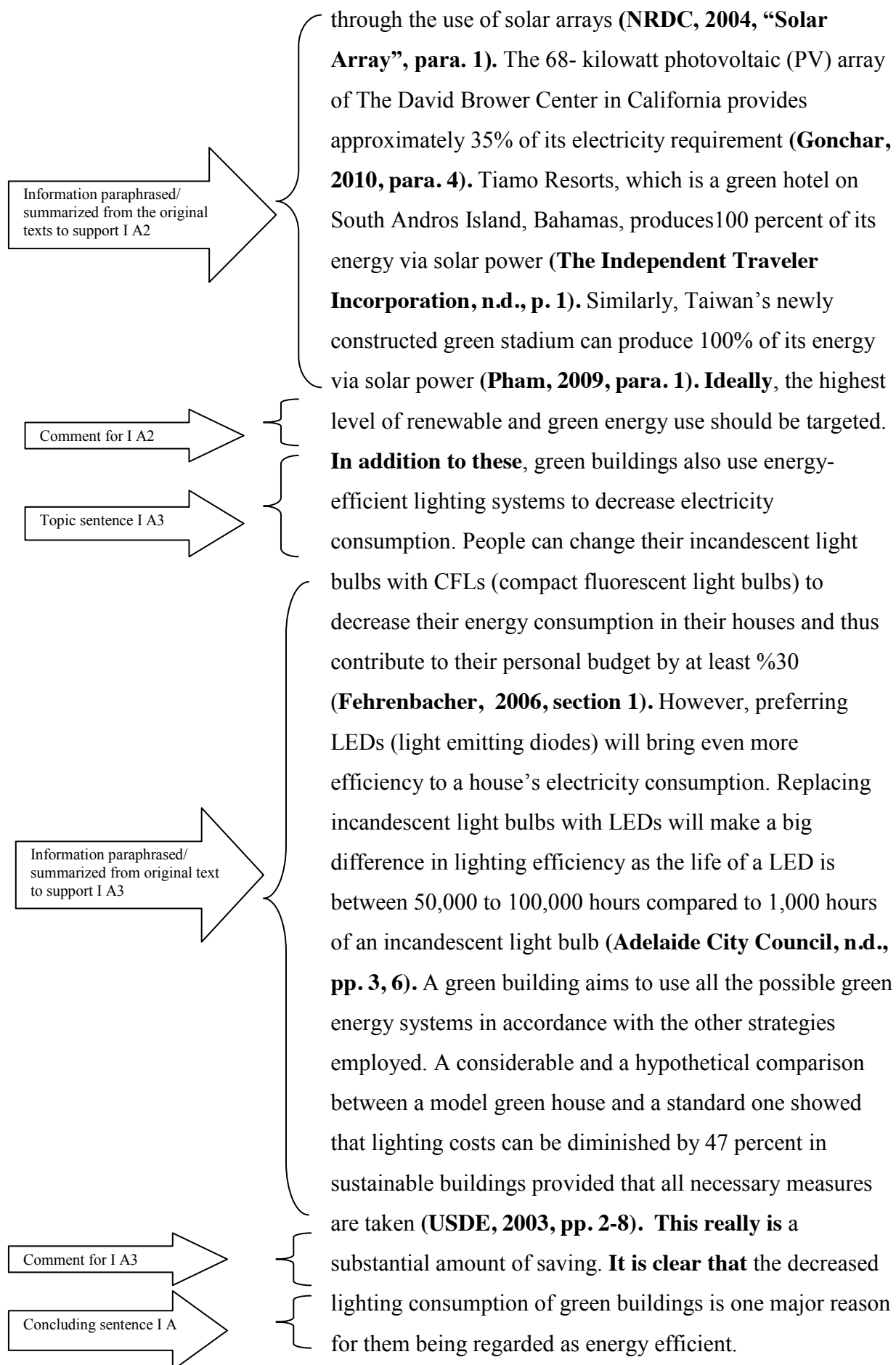
1. Maximum use of daylight (Kats, 2003, p. 4; HK Green Building Technology Net, n.d., “Daylight Utilization”, para. 2-4, 6, 8)
2. Use of solar power: Photovoltaics (NRDC, 2004, “Solar Array”, para. 1; Gonchar, 2010, para. 4; The Independent Traveler Incorporation, n.d., p. 1; Pham, 2009, para. 1)
3. Energy-efficient lighting systems (Fehrenbacher, 2006, section 1; Adelaide City Council, n.d., pp. 3, 6; USDE, 2003, pp. 2-8)

##### B. Reduced heating/cooling expenses

1. Planted roofs and trees around the buildings (E. C. Snodgrass & L. L. Snodgrass, 2006, p. 22; Akbari, Kurn, Bretz & Hanford cited in US EPA, n.d., p. 2; Sandifer & Givoni cited in US EPA, n.d., p. 2; HK Green Building Technology Net, n.d., “Green Roofs”, para. 3)
2. Solar shading devices (HK Green Building Technology Net, n.d., “Solar Shading Devices”, para. 1-2)
3. Energy-efficient windows (HK Green Building Technology Net, n.d., “Windows and Glazing”, para. 1-10; USDE, 2003, pp. 2-8)

Below are the **A** and **B paragraphs** of the paper about green buildings. The A paragraph is *specially formatted* so that it shows the components of the paragraph for clear understanding.





Below is paragraph B. It is formatted according to the requirements of the APA style.  
See page 218 for formatting tips.

#### **Paragraph I B**

Apart from reducing the lighting expenses, green buildings also manage a noteworthy decrease in the heating and cooling expenses. One way of doing this is through planted green roofs. E. C. Snodgrass and L. L. Snodgrass explain that the plants on the roofs lead to a cooling effect as they provide shading and evapotranspiration. They also insulate the building to a great extent. They give the City Hall in Chicago, with extensive green plantation on its roof, as an example. Scientists working in Lawrence Berkeley National Laboratory in California found that green roofs allowed savings in the yearly cooling costs that reach tens of millions of dollars (2006, p. 22). As research by Akbari, Kurn, Bretz and Hanford (cited in US EPA, n.d., p. 2) showed, shading provided by trees on walls and roofs leads to a decrease in the surface temperature by 11 to 25 degrees centigrade. Sandifer and Givoni's research (cited in US EPA, n.d., p. 2) also indicated that specifically the vine leaves on the walls decrease the heat accumulated on the walls up to 20 degrees centigrade. As explained by HK Green Building Technology Net, the use of green roofs will block the heat transfer from the roof into the building, thus decreasing the power consumption of air-conditioning, which is desirable especially in warm climates where the air-conditioning use is elevated, such as Hong Kong (n.d., "Green Roofs", para. 3). These biological solutions are surely not hard to realize. In addition to natural shading provided by green roofs and trees, solar shading devices are also effective in decreasing the energy consumption of a building. These shading devices control the amount of daylight that will enter into the building and they can be arranged so that they prevent the building from heating up in warmer seasons but allow the building to receive more sunlight in cooler times of the year (HK Green Building Technology Net, n.d., "Solar Shading Devices", para. 1-2). Obviously, these shading devices will contribute to

cooling savings to a great extent. Also, energy-efficient windows help to maintain optimum temperature in a building. HK Green Building Technology Net stated that for preventing undesired heat loss or gain, probable glazing options are tinted glazing, low-emissivity glass or double glazing with gas filling. All these applications increase the efficiency of windows, which will result in energy saving (n.d., “Windows and Glazing”, para. 1-10). In USDE’s comparison of a hypothetical green house with a standard one, it was seen that cooling costs can be diminished by 27.1 percent and heating costs can be minimized by 28.9 percent in a green building where energy efficiency is provided with such strategies (2003, pp. 2-8). It is clear that a decreased consumption of heating will be achieved with these systems and this will positively affect the efficiency of green buildings. All things considered, one cannot deny the fact that the green building concept is the most preferable solution for saving energy in a building.

(Adapted from the work of Nazım Atlı, Sadık Sınmaz, Cansu Mete & E. Egemen Arslan)

## **The Outline division for I A & I B paragraphs of the paper about “Biomimetics”**

### Usage Area of Biomimetics

Thesis: Biomimetics is a new technology which is the application of methods and systems found in nature to medicine, industry, and architecture.

#### I. Medicine

##### A. Inspired by animals

1. Medical devices (Dume, 2008, para. 1, 5-6; Rosen & Abookasis, 2003, para. 1-2)
2. Prostheses (Eisenberg, 2003, para. 5-6; “Bionic Arm”, 2007, para. 1-3)

##### B. Inspired by humans

1. Vital body organs Franklin Institute, n.d., para. 1-3; “Model for Implantable Artificial Kidney”, 2010, para. 2, 4, 8, 11)
2. Skeletal systems (Bar-Cohen, 2004, para. 2, 4, 7, Singh, Tuli & Jindal, 2010, para. 6, 17, 18)

### **Paragraph I A**

The first field in which biomimetics plays a noteworthy role is medicine. To begin with, the animal kingdom has been a very valuable source of inspiration for biomimetic applications connected with human health. Primarily, this influence can be seen in many of today’s medical devices. Dume (2008) states that micro needles, inspired by the way female mosquitoes draw blood, have proven to be pain free and are as tiny as the mosquito’s mouthparts. These needles are made from titanium and its alloys to ensure that they have high strength and resilience, which minimizes their possibility of breaking as patients receive injections (para. 1, 5-6). According to a study by Rosen and Abookasis (2003), the optical

imaging of biological tissue has been enhanced by copying the visual system of flies which collect many images at the same time, composing them into a single view of an object (para. 1-2). Clearly, these new medical devices make the practice of medicine much easier and more effective, illustrating how medical science can benefit from the specialised attributes of animals. Moreover, the design of certain prostheses has also been inspired by animals. Eisenberg (2003) explains that the acute directional hearing ability of the female *Ormia ochracea*, a parasitic fly, can accurately locate a host cricket by the sound it makes. By mimicking this fly's ear, scientists are working on a miniature microphone to be used as a hearing aid that should have the amazing ability to zoom in on specific target sounds (para. 5-6). Another example of a prosthesis inspired by animals is given in the article "Bionic Arm", which outlines the cost and durability benefits of a German engineered bionic arm called ISELLA that mimics the flexibility and ease of movement of an elephant's trunk (2007, para. 1-3). As can be clearly seen, not only artificial sense organs, but also whole prosthetic limbs are sometimes enhanced through biomimicry of animals. Consequently, it can be said that both medical devices and prostheses inspired by the anatomy of animals can have a direct and sometimes profoundly positive effect on the quality of life of their human beneficiaries.

#### **Paragraph I B**

In addition to the influence of animals, the physiology of humans is another obvious source of inspiration for biomimicry. This is borne out by the many medical breakthroughs in the field of artificial vital organs. According to research of the Franklin Institute, an artificial heart called Jarvik-7, activated and controlled by an extrinsic power mechanism, was manufactured by an American medical scientist reducing the necessity of donor hearts. The workings of an artificial and real heart are almost identical, but the artificial heart replaces



living muscle with plastic, aluminium and Dacron polyester (n.d., para. 1-3). Moreover, it is mentioned in the article “Model for Implantable Artificial Kidney” that to convey most of the health benefits of a real kidney, an implantable artificial kidney is manufactured by imitating the metabolic and water-balancing functions of its natural counterpart; an important invention that meets the shortfall created by inadequate kidney donation (2010, para. 2, 4, 8, 11). The medical miracle of implanting manufactured vital organs can be a lifesaver, and because of this artificial organ technology is a significant research area. Similarly, the area of artificial skeletal systems has a strong reliance on biomimetics. In particular, as Bar-Cohen states, scientists are hopeful that Electroactive Polymers (EAP) will one day serve as a realistic alternative to human muscle, with their lifelike features of silent operation, resilient structure, high harm toleration and high actuation tension. Unfortunately, the usage of these man-made materials is still expensive and this development project has a long way to go before the creation of the first bionic human (2004, para. 2, 4, 7). Another area of medicine that most people are familiar with and which regularly employs implants and devices designed along biomimetic principles is dentistry. It is emphasized by Singh, Tuli and Jindal that scientists in the field of restorative dentistry have been conducting biomimetic studies which aim to stimulate the generation of materials such as dentin by introducing molecular scaffolds, a technique which was developed by the close observation of the natural material synthesis process (2010, para. 6, 17, 18). To sum up, research and development throughout a wide spectrum of medical science disciplines has benefitted from and continues to make use of the lessons to be learnt from living organisms.

(Adapted from the work of Ceren Yılmaz, Ayşegül Büyükşahin & Pınar Afşin)

## **Incorporating tables and figures into the paper**

Use of tables and figures in research is especially beneficial in terms of clarification and increasing reliability. The purpose of using such material is to effectively present real data, explain complex relationships, or display experiment results. However, tables or figures should not duplicate already existing information in the text. Instead, they should supplement the assertions by providing numerical, statistical or visual data.

Every table or figure incorporated in the paper should be referred to in the text. Tables and figures are not just placed at the end of the paper without any explanation. Generally, tables will include quantitative information while figures can be graphs, charts or pictures, which may be more clearly understood when explained in a caption.

For ethical purposes, when using tables or figures from a source that has copyright or from an unpublished source, it is important to ask for permission from the creator of the original material before reprinting or adapting it in the paper. As well as the permission, the correct reference information should also be provided in research papers. When an article is submitted for publication, this kind of written permission is usually enclosed along with the paper to prove that copyright laws have not been breached.

### **This is how a reference is given underneath the figure/table:**

From “Air tanker accidents: NTSB pinpoints crash cause,” by J. M. Kalil, 2004, *Las Vegas Review-Journal*.

Copyright 1997-2010 by Las Vegas Review-Journal.

Tables and Figures are placed at the end of the paper, following the “References” page. Each table and/or figure is given a new Arabic number. Do not use the number of the table as it appears in the original source. As well as a number, also give a title to the table or figure, different to the one in the original source. Every table and figure must appear on a separate page.

### **When citing a table or figure in the text, refer to it by using the number given to it.**

- As can be seen in Table 1, by reducing job classification and with the help of an implementation team, workers’ convenience increases (Ferravanti cited in Fjermestad & Chakrabarti, 1993, pp. 251, 260, 264).
- An example of a prosthesis inspired by animals is given in the article “Bionic Arm” (2007, para. 1-3), which outlines the cost and durability benefits of a German engineered bionic arm called ISELLA that mimics the flexibility and ease of movement of an elephant’s trunk (see Figure 1).

### **Format rules for tables**

Use Arabic numbers for numbering each table individually (Table 1). Write the title of the table immediately underneath the table number in italics. The first letter of each word in the title should be capitalized. The table should be made up of rows and columns with clear headings. You can explain or add information about the table underneath it, if necessary. Type *Note* in italics and then type the note. Do not put the note itself in italics. Preferably, type it in font size 12. If the table is adapted from a source, include the reference information directly after the note. Each table should be given on a separate page.

#### **Table title example:**

Table 1.

*Dual Fuel Price Comparison.*

### **Format rules for figures**

After the figure ends, underneath it, the word *Figure* is typed and it should be given an *Arabic number* in italics, followed by a period. Following the number, the figure caption is written. The caption is not italicized.

The caption serves both as a title and an explanation of the figure and should be brief, but clear. The caption should include sufficient information to be able to clarify what the figure is about without having to refer to the text. Any explanation of symbols should be given within the figure. These are called legends. The figure explanations should be typed preferably in font size 12. Each figure should appear on a separate page.

#### **Figure caption example:**

*Figure 1.* The photo shows a view of Quebec Bridge. This design is made by the combination of two different truss bridge types, which creates an elegant look.

### Sample Table from a paper on “Building Materials”

Table 1.

*Preliminary Results of an Ongoing Research on Embodied Energy of Building Materials in Turkey.*

Material	Specification	Data	Units	Source of Data
Timber	Pine	0.144	MJ/kg	Manufacturer
Concrete	Used in infrastructure and urban pavements	18	MJ/m <sup>3</sup>	Manufacturer
Concrete	Structural walls (in 19x39x9cm blocks)	1541	MJ/m <sup>3</sup>	Manufacturer
Brick	Fired brick	1.9	MJ/kg	Manufacturer
Metal	Curtain Wall (structural system)	0.018	MJ/kg	Manufacturer

*Note.* The table shows the results of research conducted in 2005 in order to collect data about the embodied energy of different building materials in Turkey. Embodied energy is the energy consumed by all of the processes associated with the production of a building, from the acquisition of natural resources to product delivery, including mining, manufacturing of materials and equipment, transport and administrative functions.

From “*A research on embodied energy of building materials: Reflections on Turkey,*” by A. Ciravoglu, 2005, Proceedings of the 2005 World Sustainable Building Conference in Tokyo, pp. 910-917, 27-29 September 2005, Tokyo, Japan.

**Sample Figure from a paper on “Green Architecture”**



*Figure 1.* Bio-lung made for EXPO 2005 in order to show different options for the survival of cities such as covering the walls of buildings with greenery/foilage. This project was made for World Exposition 2005, which took place in Aichi, Japan under the theme of “Nature’s Wisdom”. The project realizes EXPO’s theme which is “fusing Asia’s traditional wisdom with modern science and technology, to create a better world where humankind and nature can co-exist in harmony”.

From “*A critique of environmentalism in architecture: Comparative analysis of World Expositions of 2000 and 2005,*” by A. Ciravoglu, 2007, Proceedings of LIVENARCH III, 3<sup>rd</sup> International Congress on Livable Environments and Architecture, Volume III, pp. 933-944, ISBN: 978-975-01716-0-4, Karadeniz Technical University Faculty of Architecture, Department of Architecture, July 5-7 2007, Trabzon, Turkey.



### Sample Figure from a paper on “Antoni Gaudi”



*Figure 1.* Casa Milà in Barcelona designed by Antoni Gaudí is a striking example of biomorphic architecture in which organic shapes are used. For example, here the stone has gained fluidity. Not even one straight line is used, which makes it differ from the traditional architecture. Also, the height of the pillars and the ceilings are not the same. It is considered by many as the “predecessor” of biomorphic buildings.

Copyright: D. Vidana Tavaşoğlu.

## Introductory paragraph

The introduction is a simple paragraph that draws the reader towards the topic of the research paper.

It should start with a big, simple concept that is familiar to everyone who reads it and each sentence will be more specific and refined until it ends with the thesis statement.

The introduction should be organized in a way to create an expectancy of what lies ahead by providing a link between the thesis statement and the remainder of the paper, but at the same time, there should be an element of curiosity for the reader to want to find out more.

### Points to consider when devising the introduction

- **Impression:** Convey noteworthy information that will capture the readers' attention.
- **Clarity:** Use precise vocabulary and be succinct.
- **Coherence and unity:** Be consistent and fluent by using transition signals.
- **Brevity:** Be concise and stick to the point. Do not exceed one page. Generally, half a page should be enough.
- **Conformity.** Be compliant to academic conventions, especially in the use of formal style/ words. Do not use first person pronouns.
- **Tone:** Be straightforward and formal. Do not start by saying, "In this paper I will demonstrate..." Make declarative statements.
- **Vagueness:** Do not try to fill the introduction with a string of elusive remarks.
- **Over generalization:** Do not start with very broad "Since the beginning of time..." or "As technology develops day by day..." statements.

### Main components of an introductory paragraph

- **Background information** (from general to specific): When writing an introductory paragraph, move from a general point towards the narrowed topic of the thesis statement. Give chronological data or historical information wherever applicable. In some cases, it is better to define the problem first and then mention the key ideas that will be discussed. Refer to sources if necessary and do not forget to cite in case of adding source information.
- **Definition:** Include a definition of technical terms related to the topic, especially if the terminology needs to be clarified. Refer to sources for a more scientific definition and do not

forget to cite. However, avoid using dictionary definitions and refrain from starting the introduction with a definition.

- **Statements which indicate the importance of the topic:** The reasons explaining the significance of the topic will assure the reader that the topic is worth reading and thinking about and will also justify the rationale in dealing with this particular subject.
- **Previous work on the topic:** Studies conducted on a particular topic by various other researchers indicate that the topic is an area of great interest and has been investigated.
- **Statistics, examples, memorable events, etc.:** Information from sources in the form of relevant paraphrases or striking quotations may be included if they contribute to the introduction. Do not forget to cite the source material.
- **Thesis:** The paragraph should be well organized and planned bearing in mind that the paragraph ends with the thesis statement.

### **Sample introductory paragraph on “Useful Features of Nano textiles”**

Man’s curious nature allows the making of significant innovations. The quest for the best and more advanced always leads to new discoveries as preceding work becomes unsatisfactory. The most amazing breakthroughs have been achieved by scientists in the last century. One recent advance in the scientific world is nanotechnology which permits the manipulation of atoms at a nanometer (1 billionth of a meter) level. It was in 1959 that the notion of nanotechnology first arose, when American physicist Richard P. Feynman asked the question, “Why cannot we write the entire 24 volumes of the Encyclopedia Britannica on the head of a pin?” (Feynman quoted in Zimmerman Jones, n.d., “Feynman & Nanotechnology”). The late 1980s saw the emergence of extensive research in the field of nanotechnology with the book *Engines of Creation* by K. Eric Drexler (Zimmerman Jones, n.d., “Spread of \*Nanotechnology”). The textile industry is among the leading industries to have benefited from the revolution of nanotechnology. Fabrics specially treated with nanoscale applications



have initiated a huge development in textiles, now widely known as smart textiles. The attachment of nanoparticles to the surface of fabrics has resulted in various useful functions making them impervious to various chemicals and liquids. The functions of smart textiles have proved to be indispensable for many different areas. These high performance garments are taking clothing to an entirely new level. Applications of nanotechnology into textiles will surely provide very important performance innovations in many fields such as healthcare, sports and military. Current techniques applied on nanoscale will make it possible to alter or to extend the functionalities of textiles, while adding intelligence to them. Without doubt, these smart textiles enhanced with nanotechnology will have a superior place in the sector as they present unique protective, functional and electronic features.

## **Analysis**

The introduction above has the following components.

**Opening and background information:** Man's curious nature allows the making of significant innovations. The quest for the best and more advanced always leads to new discoveries as preceding work becomes unsatisfactory. The most amazing breakthroughs have been achieved by scientists in the last century.

**Definition:** One recent advance in the scientific world is nanotechnology which permits the manipulation of atoms at a nanometer (1 billionth of a meter) level.

**Quotation:** It was in 1959 that the notion of nanotechnology first arose, when American physicist Richard P. Feynman asked the question, "Why cannot we write the entire 24 volumes of the Encyclopedia Britannica on the head of a pin?" (Feynman quoted in Zimmerman Jones, n.d., "Feynman & Nanotechnology").

**Previous work:** The late 1980s saw the emergence of extensive research in the field of nanotechnology with the book *Engines of Creation* by K. Eric Drexler (Zimmerman Jones, n.d., "Spread of Nanotechnology"). The textile industry is among the leading industries to have benefited from the revolution of nanotechnology. Fabrics specially treated with nanoscale applications have initiated a huge development in textiles, now widely known as smart textiles. The attachment of

nanoparticles to the surface of fabrics has resulted in various useful functions making them impervious to various chemicals and liquids.

**Sentences which show the importance of the topic:** The functions of smart textiles have proved to be indispensable for many different areas. These high performance garments are taking clothing to an entirely new level. Applications of nanotechnology into textiles will surely provide very important performance innovations in many fields such as healthcare, sports and military. Current techniques applied on nanoscale will make it possible to alter or to extend the functionalities of textiles, while adding intelligence to them.

**Thesis:** Without doubt, these smart textiles enhanced with nanotechnology will have a superior place in the sector as they present unique protective, functional and electronic features.

## Concluding paragraph

To draw all the main ideas together, recapture the points mentioned in the paper and strengthen the argument, a paper must come to a close with a conclusion. A paper will not be complete without a suitable finale.

### Main components of a concluding paragraph

- **A restatement of the argument:** The conclusion begins with the restatement of the thesis statement. This does not have to be one sentence. While rewording the thesis, first rewrite the argument. Then, make use of the outline to summarize the main ideas in each division to remind the readers of how the paper's point of view was supported. The ideas in each division may be summarized separately to clarify each point.
- **A deduction drawn from the body of the paper:** Try to add a conclusive remark based on the research findings you presented in the paper.
- **A prediction for the future:** Based on evidence related to the current situation, it may be possible to speculate about the future.
- **Writer's personal opinion on the topic:** This could be stated either as advice, a warning or a suggestion. Beginnings such as "In my opinion ..." etc. are informal and therefore should not be used.

- **Recommendations or suggestions for future study:** The concluding paragraph should end with recommendations or suggestions for future study because every research should be reviewed or extended by others for scientific developments to continue.
- **In the conclusion, new information should never be presented:** The concluding paragraph is not the place to introduce a new idea as the paper is ending and nothing can be explained properly in the last paragraph.

### **Sample concluding paragraph**

In conclusion, nanotechnology serves the textile industry by offering many useful features. Apart from textiles' basic functions such as covering the body, they present extra specialties due to the wonders of nanotechnology. First of all, they are protective. Not only will people be protected against physical influences but also against biological impacts. Nanotextiles are also functional. People will feel more comfortable and clean while wearing these fabrics. Finally, they have beneficial electronic features. Both the wearable and non wearable fabrics will bring easiness to the area of textiles with their electronic features. For all these reasons, these smart textiles prove to be very important innovations. Their capabilities can go far beyond the present applications in no time. It seems inevitable that textile products produced using nanotechnology will soon be widespread, making people's life more convenient in many ways. Therefore, the importance of nanotech-textiles should be well understood by companies all over the world. More research and development funds should be supplied for nanoscience studies both by governments and private enterprises. Meanwhile, further research is recommended in nanotechnology applications in textiles to extend their special features.

### **Analysis**

The outline below and the following analysis show how the main ideas have been summarized and deductions and recommendations added to create the concluding paragraph on nano textiles.

### The Advantageous Features of Fiber Nanotech-Textiles

Thesis: Without doubt, smart textiles enhanced with nanotechnology will take a leading place in the sector as they present unique protective, functional and electronic features.

#### I. Protective

##### A. Protection from **physical influences**

1. UV protective
2. Water-proof

##### B. Protective to **biological influences**

1. Germ proof
2. Insect repellant

#### II. Functional

##### A. **Comfort**

1. Wrinkle resistant
2. Anti-static

##### B. **Cleanliness**

1. Anti-stain
2. Odor control

#### III. Electronic

##### A. **Wearable** electronic textiles

1. Textiles having sensitivity to environmental conditions
2. Textiles with self-healing and cleaning properties

##### B. **Non-wearable** electronic textiles

1. Electric plaid
2. Wireless fabric keyboards

## **The main components of the concluding paragraph**

**Restatement of the argument:** In conclusion, nanotechnology serves the textile industry by offering many useful features. Apart from textiles' basic functions such as covering the body, they present extra specialties due to the wonders of nanotechnology.

### **Summary of the ideas in I A & B:**

First of all, they are **protective**. Not only will people be protected against **physical influences** but also **against biological impacts**.

### **Summary of the ideas in II A & B:**

Nanotextiles are also **functional**. People will feel more **comfortable and clean** while wearing these fabrics.

### **Summary of the ideas in III A & B:**

Finally, they have beneficial **electronic features**. Both the **wearable** and **non wearable** fabrics will bring easiness to the area of textiles with their electronic features.

**Deduction:** For all these reasons, these smart textiles prove to be very important innovations. Their capabilities can go far beyond the present applications in no time.

**Prediction:** It seems inevitable that textile products produced using nanotechnology will soon be widespread, making people's life more convenient in many ways.

**Advice-Recommendation:** Therefore, the importance of nanotech-textiles should be well understood by companies all over the world. More research and development funds should be supplied for nanoscience studies both by governments and private enterprises.

**Recommendation for further study on this topic:** Meanwhile, further research is recommended in nanotechnology applications in textiles to extend their special features.

(The introduction and the concluding paragraphs adapted from the research paper of Alliye Kara)

Below are two more sample paragraphs. The first one is an introductory paragraph of a research paper on “Carbon Footprint”. The next one is the concluding paragraph of the same paper.

In the 21st century there has been an increase in natural disasters such as floods, hurricanes and droughts in addition to very worrying longer term environmental changes such as acid rain, the melting of ice masses and the rising of the sea level, all of which have resulted in the impairment of the natural balance on the Earth. There are various reasons for this imbalance, however the unintentional and irresponsible activities of humans are the most crucial factors. The greatest problem for the Earth is the climate change, which is related with carbon emissions caused by human activities. Carbon emissions are a natural part of human life, and as carbon based life forms all human beings have a carbon footprint. This is the amount of carbon dioxide that a person causes to be emitted. Although it is not possible to live without generating any carbon dioxide, it is quite possible to alleviate the environmental pollution caused in the course of daily life if the necessary precautions are taken by the individuals who accept responsibility for the environment. Therefore it is clear that people can reduce their own carbon footprint by paying attention to the main issues in daily life such as transportation, nutrition, heating-cooling and use of electricity.

Taking all this into consideration, it can be said that everyone can contribute to the effort to protect the environment by taking a few easy measures with regard to transportation, nutrition, heating and cooling, and the use of electricity. It can be easily seen that people’s careless attitudes in everyday habits, have a considerable effect on their carbon footprint. If carbon emission rates in the world keep increasing at this speed, the earth will become a place where neither humans nor any other living things can survive. To hinder this harmful trend,

cutting down personal carbon footprint is the only option that people can choose. Every individual should be aware that this is a human responsibility, and see it as a duty to leave a habitable world for future generations. As the Native Americans put it, “Treat the earth well: it was not given to you by your parents, it was loaned to you by your children. We do not inherit the Earth from our Ancestors, we borrow it from our Children.”

(Adapted from the study of Metin Tezcan, Dila Türkmen, Şamil Yılmaz and Said Gülşen)

# **FINALIZING PROCESS**

## **Preparing the final paper for submission**

1. A title page must be prepared by writing title, writer's name, faculty and student number. This information must be centered and appear towards the top of the page. The first letter of the main words in the title must be capitalized. Do not capitalize articles, short prepositions and conjunctions. However, words that have more than four letters must be capitalized. At the bottom of the page, centered, should be the name of the course, the instructor of the course and the date that the paper was written.
2. Every page must have a number. Numbering should begin from the title page. The numbers should appear on the top right hand corner of the pages.
3. Every page, starting from the title page should contain a shortened version of the title (written in capital letters) on the top left hand corner.
4. The outline of the paper should be placed following the title page.
5. All the paragraphs, starting with the introduction paragraph, should be indented by half an inch (2,5 cm).

The paragraphs should start on a new page after the outline or the abstract.

6. The References page should be placed after the text has finished, on a separate page.
7. Table and/or Figures should follow the References, on a separate page.
8. Throughout the paper, left alignment should be used. Do not justify.
9. Margins should be 1 inch (2.54 cm.)
10. The final paper should include the submission of all the sources that have been used.

See the Appendix for typing and formatting tips.



## **Definition and purpose of abstracts**

An abstract is a summary of a research paper, stating the purpose, findings, results and conclusion in a succinct way and providing an overview of the whole paper. It is separate from the paper and can stand alone. As an abstract is written in the form of a paragraph, it must start with an introduction, develop with the body and end with a conclusion. Just like any paragraph, an abstract must show unity and coherence while briefly summarizing the main parts of the paper without the inclusion of any additional new information that does not exist in the paper itself or any detail. The length of the abstract should not exceed more than 120 words. Also, it is important that no cited information is used in the abstract.

In order to determine the value of the paper to be submitted, generally magazines and journals require abstracts for articles that are going to be published. In addition, certain edited books which have chapters written by different writers often include abstracts of each chapter. Moreover, meetings, symposiums or conferences of a scientific nature often make use of abstracts for the presentation of the topics.

When searching for articles for the purpose of using information in your own research paper, often it is easier to read the abstracts of long articles beforehand, instead of spending time reading the whole article, to decide whether or not the article bears any relevance to your paper. However, it should be noted that in the paper, research findings should not be based solely on an abstract of an article, but rather conclusions should be drawn from the whole work.

It is essential to prepare an outline at the beginning of the research to organize the structure of the paper; however, outlines are not always needed with the final paper. Sometimes an abstract may be required. An abstract functions in the same way as an outline in giving a general idea about what the paper will be discussing, so preparing an outline of the paper will not be necessary if the paper is to be submitted with an abstract.

See the sample paper on ‘Nanotechnology’ for a research paper written with an abstract on pages 167-185.

## **Oral presentation**

There may be various occasions when an oral presentation of a written paper or report is required. This may be for academic purposes, such as the defence of a dissertation, or in front of a class. Other occasions may involve a presentation at a meeting, a conference, a symposium, a seminar or a workshop. It is important to consider that careful planning, organization and preparation will be necessary for an effective delivery. In other words, the process of an effective presentation consists of 4 stages: planning, organization, preparation and delivery.

### **I. Planning**

“If you fail to plan, you plan to fail”

Abraham Lincoln

As the above proverb suggests, planning is the key to success. The planning of a presentation should mainly focus on the consideration of two areas: the objective of the presentation and the profile of the audience.

Considering the objective of presentation is thinking about why there is a need for such a presentation. Researchers may choose to give a presentation of their findings at any stage (such as the initial stage; when they decide on the scope of their research, or the final stage; when they convey the information they have gathered). Therefore, objectives such as agreeing on the major divisions of a paper, deciding on the argument of a paper, or the approach used to defend a paper, should be clearly identified at the very beginning of the process.

The profile of audience is determined through factors such as size, experience, and attitude. When these determinants are precisely analysed the outcome serves for the correct identification of the style of presentation.

### **II. Organization**

Good organization is the second step to successful presentations.

For the presenter the presentation serves for two purposes: 1) delivering the idea in the best way possible; 2) making the audience fully comprehend and actively retain the information.

To reach these aims the presenter should organize the presentation to include all necessary details and repeat the most significant when appropriate.

The following points form the steps involved in the organization stage:

- Limit ideas to an adequate number
- Include adequate details
- Form as many body paragraphs as necessary
- Organize the content of body paragraphs
- Repeat the most significant points as many times as possible
- Make an effective introduction and an assertive conclusion

Briefly explain the topic, the argument brought to that topic and the details of the major divisions. Do not go into details such as cited material.

The presentation has to be a lot more condensed version of the actual research. A master's thesis may include approximately 100 pages of details; however, its presentation should actually include only the major points, two to four in practice, and should be a lot shorter; not taking more than 20 minutes.

Moreover, especially in business presentations, senior people like board members have short attention spans and thus they look for a compact and effective presentation. A board member will need to hear everything relevant in a maximum time of 20 minutes, even though this is a business plan covering a whole year.

### **The introduction**

The introduction opens the presentation by giving a clear statement of what the presentation is designed to achieve. As in research paper introductions, taking the attention of the audience through an effective opening should not be underestimated. Telling a joke, describing a personal experience, asking pertinent questions, and showing an eye-catching slide or a movie are only some of the tools used for increasing the interest of the audience. For example, a research paper discussing advanced traction control systems in automobiles could start with a 20 second movie showing a brutal car crash supported with strong sound effects. In addition, the introduction also serves to introduce the presenters. This is especially true in business presentations where strong presenters choose to emphasize their experience and reinforce their credibility.

### **The body**

The most problematic or challenging part of any presentation is structuring the body. Here, the essential point to consider should be which ideas or details to cover the presentation.

The major points of discussion should be selected and developed with adequate support from details and examples. A presenter should evaluate and describe the cited material given in the research paper but refrain from listing the citations in speech as the audience wants to hear the perspective on the topic, and not the formatting details that can be found in the submitted research paper.

The presentation should be simple enough for every member of the audience to understand it completely. In other words, keep the message clear and understandable. Also, repeat the important points when necessary to increase audience comprehension and retention.

### **The conclusion**

While the introduction opens the presentation, the conclusion closes it by summarizing the main points discussed and making an effective final statement.

As presenters reach the conclusion stage, they prefer to use finishing signals such as “In conclusion...” and “To sum up...” to remind the audience that it is almost the end and the only remaining thing is a brief summary of the main points. When the summarizing stage is completed, be sure to make a powerful exit with a quotation, an anecdote or a statement.

### **III. Preparation**

The Preparation stage involves both the preparation of the material to be delivered, and also the preparation of the presenter.

#### **Advantages of preparing powerpoint slides**

PowerPoint has become an indispensable tool for any kind of presentation. Whether it is a highly professional business presentation or a relatively simple academic presentation, the use of PowerPoint has become a vital requirement.

Main purpose of preparing and using slides in a presentation is supporting the activity visually and increasing audience comprehension. Making a long speech in front of a large audience is difficult without the help of any visual material. As some studies show, 85 percent of learning is done visually. Visual materials divert some of the focus of the audience from the presenter to the material shown, allowing the presenter to better focus on their speech and consequently to increase audience interest on the topic. In this way, inexperienced speakers can feel more confident, increasing the quality of their presentation.

Besides this invaluable advantage, visual materials also emphasize and better explain main points.

With PowerPoint or any other presentation programme it is possible to bring a lot of colour to a relatively dull topic by means of layouts, templates, fonts, colours, and multimedia elements such as sound, animation, video, tables, charts, graphic, clip art, and pictures from personal files.

Text inserted in a slide is one way of creating variety in a slide. By playing with the font size, colour and direction of a word it is possible to easily take attention of the audience. To emphasize a word; increase or decrease the font of one word in a phrase, change the alignment and/or direction of a word, change the colour of a word or make it bold, use only one word in a slide with a big font size. Moreover, slides may be animated by making text fly in, fade or wipe.

Sometimes one picture tells the whole story. Therefore, try to take attention by using carefully selected pictures in the slides.

Including a video within a slide show is also possible. Turning the whole slide show into a movie is even better, but of course such a thing should be carefully planned and arranged.

Moreover, video is easier and faster in transmitting the message to the audience. More importantly, it is fun and action-oriented. Everybody loves watching a video as long as it is short. Thus, choose movies that reflect the objective and aid in the decoding of the message.

Slides make a presentation look more professional. However, to achieve this goal there are some crucial points to consider.

Slides should be concise, easy to follow, and they should emphasize the key concepts. The common mistake made by novice presenters is filling a slide with too many words and leaving no blank space between the lines and in this way lessening the degree of audience comprehension. According to Guffey, the maximum number of words that can be put in a slide is 49. Additionally, a slide with more than 7 words in a line or more than 7 lines is accepted as being cluttered (2010, p. 517). More specifically, a slide mostly contains bullet points, not sentences or paragraphs since the audience can not read and listen to the presenter at the same time. Therefore, it is the presenters' duty to narrate and further explain slides.

Parallel structure is used with bullet points. Mostly the present-tense form of the verb is used without the existence of an obvious subject.

All slides must be standardized in terms of theme, background format and style, font, font size and font color to make a professional impression. Also, for headings, subheadings and bullet points, separate standardized font choices should be made before starting to prepare the presentation. This is especially an important point if a presentation is prepared through teamwork. In such a situation all team members should agree on and strictly follow all formatting decisions.

Supporting slides with clipart, photos or pictures from the used presentation programme itself or by simply using Google not only increases audience interest by turning slides that could otherwise be called dull into more exciting ones but also creates better comprehension.

Presentation of technical or business topics requires production of statistics through tables, graphs, diagrams or charts. One thing that presenters need to be careful about in preparation of these visuals is their size. Putting each one into separate slides rather than attaching them to a bullet pointed slide is always more beneficial since the latter may cause visibility problems if they are too small.

There is a thin line between a well-prepared PowerPoint presentation and an overdone one. Novice presenters can fall into the trap of adding too many colourful effects to their presentation mainly to show off their experience of PowerPoint, but this results in the slides with exaggerated effects being better remembered than the key concepts of the presentation. Therefore, it is important to note that the only reason of adding an effect to a presentation slide is making the acknowledged concept more clear and understandable for the audience.

In practice, slides are only part of a whole. With the contribution of the presenter they form the whole story. The presenter's role is to be the storyteller. In other words, slides are just a group of bullet points decorated with multimedia elements. Without the existence of a presenter who will create a story from them and transfer it to the audience for their decoding, they can easily be perceived as meaningless imagery.

### **Preparation of the presenter**

Allow time to practise before presenting. Good speakers are those who spend enough time on their own to prepare for their speech. Repeating the speech before the actual presentation as frequently as possible is also a useful technique, sometimes known as “inner talk”.

All presentations have an allocated time limit, and staying within this limit is important whether for a scholarly or business presentation. Therefore, presenters should time themselves during practice. Learning the order of ideas in the presentation by heart and preparing themselves for the introduction and conclusion without actually memorising the lines are essential things that any presenter should do. Trying to memorize can be very risky, especially for novice speakers who may become easily stressed in front of a crowded audience and forget all their poorly memorised lines.

Even though presenters time their performance during preparation stage, the actual presentation may last much shorter than planned depending on several factors such as a hostile attitude from the audience, the anxiety level of presenters, an uninterested audience and technical problems. To

overcome these issues, a presenter should always have something extra such as slides, handouts, case studies or something else suitable for the presentation topic.

#### **IV. Delivering the presentation**

As mentioned earlier, good organization and constant repetition lead to increased audience comprehension and retention. To satisfy this goal the following three-step rule about effective presentations should be strictly followed during delivery:

Tell them what you are going to say

Say it

Tell them what you have just said

During delivery follow the format that has been prepared during organization stage. Organize your presentation in a logical way with an introduction that states the purpose of the presentation and an outline of what will be delivered, a body that discusses the main points and findings in the paper and a conclusion that summarizes the issues discussed.

All the fundamental areas concerning the topic should be discussed, but the presentation should be as brief as possible.

Give information on why that particular topic was chosen, why it was important and what kind of new knowledge was gained from researching this topic.

Discuss the topic clearly, covering the content and separating facts from opinions with the use and identification of a range and quantity of sources.

During delivery the main emphasis is on the presenter. Training, knowledge, preparation and consequently the performance of the presenter determines the fate of the presentation.

Interactivity is an important tool bringing vitality to a presentation. If the audience profile fits in size, attitude and experience, it is important to create some kind of involvement for them. As the proverb says:

Tell me, I forget.

Show me, I remember.

Involve me, I understand.

An interactive presentation is always easier to handle both for the presenters and the audience. Boredom or loss of interest is rarely an issue in presentations where the audience is actually involved in the process. More importantly, with an interactive presentation key points are much more easily reinforced as the previous proverb also stresses.

While using slides, there are some critical issues not to be missed. For example, every time the presenter clicks for a new slide, a brief pause should be taken to allow the audience to see and absorb what is given in the slide.

Then without making the pause too long, the slide should be explained by the presenter. The slides are never read. The audience can always do that without any help. While explaining, different words or phrases to the ones used on the projected slide (unless they are terminology or jargon) should be chosen. In other words, deliver fluent speech with good use of grammar, vocabulary, no pauses, and clear pronunciation. Make use of extensive vocabulary. Do not repeat the same words too often. As Guffey highlights, “Add value to the information you present” (2006, p. 518).

While speaking always watch the audience closely, do not get solely focused on the computer screen or the projected image on the wall or the curtain. If possible, take a remote control and move around the room.

Talk to the audience. Refer to the written notes only occasionally and for a short moment.

Fulfill the basic presentation skills that will capture the attention of the audience, such as eye contact, spontaneity, smoothness of flow, and facial expressiveness.

Hold the attention of the audience by encouraging participation and asking questions.

Dim the lights for better visibility, but do not darken the room completely. Provide adequate lighting in the room for the audience to follow the presenter’s facial and body movements closely. Make eye-contact as much as possible.

If the presentation is being delivered in an unfamiliar environment, be alert for technical problems. Disconnection problems between projectors and computers or connection cables, USB devices or any kind of technical or technological equipment may fail. To overcome these problems always have a back-up plan which can be as simple as distributing hand-outs and using a flip-chart or a white board to emphasize significant points.



## SAMPLE RESEARCH PAPERS

1. GMO (Adapted)
2. Nanotechnology Applications (Adapted)
3. AK-47
4. Acoustic Challenges

GMO: The Reality

Buket Köle

Molecular Biology and Genetics - Faculty of Science and Letters

090080361

Dilara Melek Karaağaç

Textile Engineering - Faculty of Textile Technologies and Design

140090701

Gamze Ceylan

Environmental Engineering - Faculty of Civil Engineering

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Zeynep Yüksel

Textile Engineering - Faculty of Textile Technologies and Design

140080052

English 201

Dilek Vidana Tavaşoğlu

May 12, 2010

## The Truth of GMO's

Thesis: Genetic modification of food, which started with the intention of finding a solution to world hunger, should be banned because while trying to boost production, it is leading to considerable damage to the environment, endangering human health and posing a risk to society in general.

### I. GMO benefits

#### A. Higher yield

1. Bt maize
2. Bt cotton

#### B. Better quality food

1. Enhanced vitamin levels
2. Longer shelf life

### II. Damage to environment

#### A. Genetic pollution and related concerns

1. Crosspollination between organic and altered plants
2. Unpredictable traits of novel plants

#### B. Agricultural pollution and related problems

1. Pesticide use
2. Herbicide use

### III. Damage to human health

A. Short term effects

1. Allergies
2. Antibiotic resistance

B. Long term effects

1. Cancer
2. Infertility

IV. Damage to society

A. Impact on farming

1. Harm to small family farming
2. Harm to diversity

B. Impact on ethics

1. Religious issues
2. Labelling issues

One of the controversial subjects of the 21<sup>st</sup> century, raising much public concern, is the application of biotechnology to food. Biotechnology is a science that is based on DNA technology to improve plants, animals, and microorganisms. From the moment it started as a new area of technology, the debate as to whether we should or should not utilize it has occupied minds. In various fields, new farming technologies are making use of genetic engineering studies and genetically modified organism study is the most significant of these studies. As mentioned by the World Health Organization, "Genetically modified organisms (GMOs) can be defined as organisms in which the genetic material (DNA) has been altered in a way that does not occur naturally" (2010, section 1). Although this modification is done for the purpose of improving or strengthening these organisms, the improvement aspect is by no means sufficient to assure people that this is problem free, as GMOs include non-natural structures which are dangerous for living beings. Chapman reports that after the tomato which was the first fruit to be genetically modified on a commercial scale at the beginning of the 1990's, research published by Dr. Arpad Pusztai in 1998 revealed the toxic nature of potatoes that had been genetically modified to include an insecticide gene, after trials conducted on lab rats. In 2000, it was found that the honey being sold in England in supermarkets had been infected with GM pollen during field testing and so began a period of refusal to grow such crops (2006). During the 90's there was no definite knowledge about the adverse effects connected with GM products; however, after years of research and studies, it is now being proven that there is considerable risk involved. Genetic modification of food, which started with the intention of finding a solution to world hunger, should be banned because while trying to boost production, it is leading to considerable damage to the environment, endangering human health and posing a risk to society in general.

It is a well-known fact that the usage of GMOs began with the urge to protect crops in order to increase production and quality. First of all, higher yield was targeted by finding solutions to the problem of pests which harm the conventional crops. Especially in areas where there are severe attacks of pests, the enhancement of crops to make them more resistant to these pests will lead to a boost in production. For example, Bt maize, which includes the insecticidal gene of the natural soil bacterium, *bacillus thuringiensis*, proved to be more resistant against the attacks of corn borers. As mentioned in the article “Spain: Experience of Bt Maize” (2008), a comparative survey was conducted between farmers who grow Bt maize, which is modified to become resistant to the European corn borer, and farmers who grow conventional maize in 3 provinces in Spain. The results of the study reflected the 2002-2004 farming period. After excluding the possibility of demographic differences between farmers, it was discovered that especially in Aragon, Bt maize yield was higher compared to the yield of conventional maize. The reason for the significant increase in yield in Aragon was stated as being related to the higher levels of corn borer infestation in this area as opposed to the other two areas (para. 2, 4, 5, “Higher Yields of Bt Maize,” para. 1). Surely, the increase in the yield will make their implementation more common in many other parts of the world.

Another example of the same kind of genetic modification is the Bt cotton, which has been genetically modified to produce Bt toxin, a kind of insecticide. This could become very popular due to cotton being very vulnerable to pest attacks. According to the article “Higher Yield from India's GMO”, the results of research conducted between modified and unmodified cotton crops grown in 150 farms, in the 3 main cotton growing states of India, showed that cotton plants that were implanted with the Bt gene inhibited the infestation of the widespread bollworm, enabling on average, an 80-90 % elevation in the yields of Bt

cotton. Writers of the report also claimed that the positive results obtained from this research pointed to the possible application of this modification to food crops grown in different parts of the world that are prone to the same type of harm from crop insects. On the other hand, despite the optimism surrounding the enhancement of cotton yields, there is some concern in India among those who oppose GM modification. Their claim is that the insects in the long run may well become immune to these GM crops (2003). Clearly, the world of science should devote more time to understand the long-term consequences of GMOs. As in all new implementations, research must be done to make sure the improvement of crops presents no future threats or in the event of doing “more harm than good”, their application must be stopped.

In addition to the increase in yield, better quality food can also be obtained with genetic modification, which can be considered an important contribution to nutrition. As an example, the vitamin levels in food products can be enhanced with the help of GMOs. EUFIC reports that rice is one of the most common sources of nutrition, especially in underdeveloped countries. Due to this substantial consumption, many diseases related with increased rice intake are seen more in these areas, particularly in young children. These are mainly deficiencies in iron and vitamin A. Such deficiencies result in many adverse health effects. Conventional rice is known to contain phytic acid which hinders the digestive system's absorption of the iron content in rice. Also, vitamin A is not found in the grain of rice. It mainly exists in the green part that does not actually reach the consumer. Following the studies conducted by Swiss and German researchers, rice has been modified to contain two new genes that will amplify both the iron and vitamin A content. Contrary to conventional rice, with modified rice grains, cooking gets rid of phytic acid, thus enabling the absorption of

iron by the digestive system. As a result of this intervention, no extra supplements of iron and vitamin A will be necessary (1999, para. 1-8). Certainly, this kind of modification in food products may bring a practical solution to the nutritional deficiency problem in certain parts of the world. What is more, the shelf life of a product can be extended with GMOs. Studies on fruit look reassuring. Buschman reports that from recent studies done on the **manipulation** of fruit at a molecular level, it was found that the shelf life of fruit prone to degradation after being picked could be lengthened by prolonging the ripening process of fruit through the use of gene modification. Fruit rapidly starts to degenerate during the ripening process due to the expression of the plant hormones and enzymes inherent in the fruit. Two main enzymes,  $\alpha$ -man and  $\beta$ -hex triggered by the plant hormone ethylene, cause the tomato to ripen quickly. After investigating the ripening process in mutant tomatoes that showed lower levels of  $\alpha$ -man and  $\beta$ -hex enzymes due to the faulty production of ethylene (a hormone that encourages the cell wall to become softer), it was discovered that the inhibition of these enzymes in tomatoes resulted in the retention of the tomatoes' colour, texture and firmness for weeks after they had been picked. It was seen that these transgenic tomatoes, with reduced enzyme expression, stayed fresher and riper for a longer time as opposed to the normal tomatoes that turned brown and soft quickly (2010, para. 1-5). Therefore, food products can now be transported to distant places or countries without the worry that they will get tainted or perish on the way. Undoubtedly, this seems to be a great benefit of GMOs and its contribution to the food industry could be immense.

Naturally, it takes years to evaluate the merits of every new technology or discovery. Some prove to be very beneficial with no harms and continue to be used for the benefit of humanity with no hesitation or doubt. However, some give rise to certain concerns related to



the health and safety of the public and the environment, despite significant contributions. Usage of GMOs is one of these controversial innovations about which there are ongoing debates and studies. Research all over the world shows that they sometimes fail to fulfil the promise of higher and better productivity in the long run and even if they appear to be useful in increasing production, while doing so, they often lead to detrimental effects in many areas.

The first disadvantage of GMO is the fact that it is harmful for the environment. In the first place, GMOs cause genetic pollution, which has destructive effects on the ecological balance. This genetic pollution is caused by the crosspollination between organic and altered plants. Cummins and Lilliston (2000) asserted that the organic plants face genetic pollution because of the pollens of genetically engineered plants dispersed by insects or the wind. When these pollens are set free in the environment, genetic drift or pollution is inevitable as the pollens will undoubtedly be carried to the nearby fields (p. 49). In 1998, it was reported that a corn field in Texas, where organic farming was applied, was threatened by genetic pollution which resulted from genetically engineered corn planting in a farm nearby. Similar cases were reported in other states and also in Europe. It was clear that genetic pollution was impossible to avoid anymore and it was too late to stop it. Therefore, an increasing necessity for a world-wide suspension of the commercialization of GMOs has been declared by farmers and environmentalists (pp. 50-51). Besides, as the genes of these modified plants are not natural but altered, their behaviour in terms of reproduction, migration and mutation are also beyond any knowledge and estimation (p. 49). The unpredictable traits of these novel plants may very well create many problems in the future and must definitely be studied deeply. Snow (2002) also pointed at the same issue by emphasizing that the cross pollination has always occurred in nature but the introduction of these altered genes into

various types of natural plants will bring with it many problems. As this gene flow could be dramatically fast and widespread, any efforts for the prevention of it will be futile. At that point, what matters most is the necessity of a risk assessment of this genetic drift (p. 542). Clearly, the primary concern of humanity against the threat of genetic pollution should be to do as much research as possible to determine the hazardous effects of this phenomenon and act accordingly. All things considered, genetic pollution cannot and should not be ignored and the governments are responsible for funding related research and finding necessary precautions and solutions.

Beside genetic pollution, GMOs also create agricultural pollution. One agricultural problem is the growth in the use of pesticides. “The rapid adoption by U.S. farmers of genetically engineered corn, soybeans and cotton has promoted increased use of pesticides ...” (Gillam, 2009, para. 1). According to a news report from Washington DC., Andrew Kimbrell, Executive Director of the Center for Food Safety stated, “These crops really promote greater use of pesticides, and cause direct harm to the environment ...” (Freese, 2008, para. 3). Naturally, pesticide resistant plants requiring more pesticide usage was not what was targeted. What is more, their harm to natural organisms and animals came as a surprise. As Cummins and Lilliston (2000) reported, genetic engineers inserted a Bt gene into the plants and created genetically engineered Bt crops. BT is the short form for the natural biopesticide *Bacillus thuringiensis* and it naturally wards off many kinds of plant pests like the potato beetles or corn-borers. Natural forms of this pesticide have been applied in organic farming for many years and as the Bt in spray form disappears from the surface of the plant in a short time under the sun, farmers have never been worried about its harmful effects. Besides, they used the spray in small doses and only when it was really necessary. However, genetically

engineered Bt crops produce excessive amounts of Bt toxin compared to conventional Bt sprays and these cannot decompose easily, but remain on the crop's surface as residue. These plants can invoke the emergence of Bt resistant superpests and organic farmers unfortunately cannot deal with these superpests in natural ways (pp. 51-52). As Cummins and Lilliston (2000) stated, different studies show BT spliced crops also harm useful soil microorganisms and insects including lacewing and ladybugs, meanwhile destroying soil productivity. Insect-eating birds are also under threat. In March 1999, in Basel, at an international session of entomologists, specialists emphasized that GM Bt crops, which had 10-20 times more toxins compared to conventional ones, were killing useful insects and soil microorganisms and could badly influence insect-eating bird populations (p. 55). In research done by New York University's researchers in December 1999, it was stated that the Bt toxins stay in the soil for nearly 8 months, blend with the soil particles and threaten soil insects for a long time (p. 56). Additionally, Cornell University scientists found out in 1999 that the pollen of the Bt corn poisoned and killed 44 % of monarch butterflies which had eaten milkweed leaves affected by Bt corn. The ones which did not die experienced 60 % weight loss (p. 54). These examples clearly show that the use of genetically engineered crops in agriculture not only increases pesticide use by creating pesticide resistant generations but also poses risks for the useful organisms or animals. In addition, another agricultural harm of GMOs is related to herbicide use. As Smith explained, the surveys made throughout the UK showed that GM crops do not directly harm weeds but as they are made tolerant to herbicides, the application of broad-spectrum herbicides intended to kill herbicide tolerant weeds kill natural varieties of weeds which are the food for many insects, bees and birds. As there are fewer weeds, the prospect of these animals' survival surely declines (2004, para. 3). As GMO Compass explains, using

herbicide resistant crops brought about an increase in the necessity for herbicide use because it triggered the development of weeds that are herbicide resistant. The surveys made in the UK revealed that herbicide applications increased the amount of weeds in a farm. These weeds block the sunlight and prevent the crops from getting nutrients from the sunlight (2006, para. 1, 5-6). Moreover, Cummins and Lilliston (2000) explained that herbicide resistant crops are a major part of genetically engineered plant industry but the present situation shows that these are the crops that threaten the farms most. The aim in modifying plants to be herbicide resistant is to make them withstand overexposure to herbicides, but in the meantime, weeds are becoming resistant to commonly used herbicides. Consequently, these “superweeds” will force the farmers to use more toxic agents to kill them. As it seems, the use of genetically modified pesticide and herbicide resistant plants have made the weed and pest problem much worse. Examples of these superweeds have been observed not only in Europe but also in Canada. For example, weeds such as wild mustard, wild radish, ryegrass and goat grass have begun to gain resistance to herbicides due to being overexposed (pp. 57-58). It is clear that herbicide resistant crops are becoming a more and more problematic issue. All in all, it can safely be said that plants modified to withstand pesticides and herbicides are leading to agricultural pollution and this pollution will definitely have negative environmental effects.

The second main damage caused by GMOs can be observed in human health. Firstly, short term impacts of GMOs create health problems. For example, GM foods may cause allergies in humans. Cummins states that a great potential disaster was prevented due to the fact that Nebraskan researchers noticed the risk of fatal allergic reactions as a result of the genetically engineered Brazil nut gene injected into soybeans. The tests made on animals did not lead to a certain conclusion so more conclusive research on people must be done to make

sure if these genetically modified soybeans could trigger fatal allergies in people allergic to the Brazil nut. In fact, one of the problems with these genetically engineered products is that they are commercialized without the requirement of enough testing on animals and humans to see if they contain increased levels of human allergens (1999, “Food Allergies”). As it is explained in the article “Can GM Foods Cause Allergies?”, if foods which are known to lead to allergies are not used in genetic engineering, their allergy potential could be reduced to a minimum if not eliminated. However, people against GM foods emphasize that there will always be a risk of allergies even in the case of adequate laboratory testing of these foods and no one can guarantee their safety. Normally, foods such as peanuts, soybeans, milk and eggs, which are known as probable allergens, are among the types of foods whose usage in genetic engineering is discouraged. This is because the effectiveness of the original genes can increase or decrease when modified. In this case, when a new gene is injected into a host plant known as having allergenic proteins, then the efficiency of original genes may increase, making the allergenic potential of the plant even higher. It is also a fact that foods that are not known as allergens may lead to allergies if genetically engineered, as the modification itself may create an unprecedented series of traits in organisms. For this reason, laboratory tests are very important. Meanwhile, there is ongoing research about removing a specific allergen from a food to make it “allergen-free”, which is regarded as a promising study (n.d., para. 1-2, 4-6, 9-12). In the light of all these explanations, it can be said that GM foods either must be banned or tested thoroughly before they are presented for human consumption. As an additional threat, GMOs lead to resistance to antibiotics. As explained by Cummins and Lilliston, when a foreign protein is inserted into a food product, these inserted proteins often get hold of another gene called an antibiotic resistance marker gene (ARM). Something which

worries the world of science is the likelihood of the integration or mating of ARM genes with the pre-existing germs or pathogens, which can then lead to fatal new outbursts of antibiotic resistant 'superbugs' such as salmonella, E.coli, *campylobacter*, tuberculosis, staph and *enterococcus*. The study of Dutch and British scientists on ARM genes also supported this probability and in 1999, the British Medical Association suggested that the use of antibiotic-resistant marker genes should be brought to an end (2000, pp. 42-43). Roseboro also warned people about the possibility of a person becoming resistant to antibiotics due to consuming foods that included antibiotic-resistant marker genes. A study of Newcastle University on seven human volunteers who use colostomy bags and twelve people with normal stomachs showed that genetically modified DNA might be transferred by bacteria and could spread around the stomach or intestines, creating immunity to antibiotic medicines (2002, para. 1-3). Taking all this into consideration, banning of antibiotic resistance marker gene seems to be a crucial necessity for the sake of the human immune system. Thus, research leads to the fact that GMOs have serious short-term consequences on human health which should not be ignored.

Apart from their short term effects, the long term exposure to GMOs also creates health problems. Primarily, cancer is one of the most widespread diseases that can be considered among their long term effects. Edwards draws people's attention to the warning of "experts in tissue diseases about the probability of developing cancer due to GM foods. According to Dr. Stanley Ewen's statement, genetically modified cauliflower may cause an increase in the risk of stomach and colon cancers and trigger the growth of malignant tumors. When cauliflower mosaic virus is used as an "activator" in GM foods, it acts like a small engine encouraging the implanted genes to manifest themselves. This virus is infectious and

can cause a growth in the size of stomach or colon or even polyps. If polyps grow fast, they are more prone to be malignant (n.d., section 1, para. 1-3, 8-9). Cummins claimed that in 1994, FDA gave the approval for the sale of Monsanto's GE recombinant Bovine Growth Hormone (rGBH) to be injected into cows to get more milk although they were warned by experts that this hormone could make the body vulnerable to cancer and could have very negative impacts on breast, prostate and colon cancer. There were studies showing that people with more IGF-1 hormone were more liable to have cancer. In 1998, the government scientists of Canada made some tests on rats to show the harms of the rGBH and they demonstrated how it affected thyroid cysts and caused cancer. Thus, the Government of Canada prohibited rGBH at the beginning of the year 1999. The European Union had banned it in 1994. However, 4-5% of the U.S cows still continue to be injected with this hormone (1999, "Increased Cancer Risks"). Taking all these facts into account, it is clear that GM is a contributing factor in the probability of getting cancer, which is another reason requiring their ban. Also, infertility is a possible long term effect of foods. As Adams expressed with a sarcastic approach, credulous consumers who accepted genetically modified products readily were going to be extinct after a few generations as these products lead to sterility (2008, para. 1-3). As emphasized by the Institute for Responsible Technology [IRT], a research funded by Austrian Federal Ministry of Health Family and Youth and applied by Veterinary University Vienna showed that eating GM corn negatively influenced the reproductive capability of mice. The lead author of the study, Professor Zentek, expressed that there was a direct relation between the increase in infertility and the GM food consumption. IRT discusses J. M. Smith's book, *Genetic Roulette*, which contains 65 serious health hazards of genetic modification, with infertility problems due to GM soy and corn among them. Apart from the rats and mice

whose young sperm cells were damaged, many US farmers reported that pigs and cows fed on GM food also lost their ability to reproduce or their fertility rate decreased. According to the news that came from India, buffaloes fed on GM cottonseed products suffered from immature births and infertility (2008, para. 1-2, 5). All these examples lead to the fact that GM foods pose a great risk for future generations and that is, on its own, a valid reason for their banning. All in all, it can safely be said that genetic modification is a threat for health, leading to many serious illnesses and their sale must definitely be prohibited.

The final negative area of damage caused by GMOs is on society. Initially, GM crops have negative effects on farming and farmers. Primarily, GM crops harm small family farming. As it is explained by Cummins and Lilliston, the nature of farming is changing. In the past, farmers used to crossbreed different kinds of crops both for their own use and also to sell in their neighborhood. Now, large companies like Pioneer Hi-Bred are selling hybrid seeds to farmers. Hybrid seeds appear to be advantageous at first because they produce more yields, but in time they prove to be very disadvantageous. Firstly, they are infertile, which means farmers have to buy new seeds every year for their production, which is not economical at all. What makes hybrid seeds even more problematic is the fact that these seeds require more chemical fertilizers, pesticides and irrigation tools. This is both an economic and environmental problem (2000, pp. 64-65). Batalion (2009) asserts that GM products initially increase the quantity of crops and farmers produce more. However, as they produce more, the prices go down and they sell them at a lower price. The same thing happens with farm animals, too. First, with the use of GM techniques, they get more milk from cows or more eggs from hens. However, this reflects in prices as a decrease in cost for the consumer and eventually, farmers end up earning less. As this cycle moves against farmers, the economic



balance of the world will turn to big firms, especially agri-input, distribution and biotech firms, and small farmers will be at the lowest level of this cycle (section 33). Taking all this into consideration, one can conclude that genetic modification will bring fatal consequences to small family farming. What is more, lack of diversity is seen as another natural impact of genetic modification. As explained by Cummins and Lilliston, farmers are discouraged to grow multiple crops or make use of traditional self-pollinating varieties of seeds but encouraged to grow huge quantities of one or two main crops such as corn or wheat. This is naturally causing a decrease in crop diversities and an increase in the dependence on a few types of weak hybrid seeds. Fox (cited in Cummins & Lilliston) expresses that half of the world's 20 vital food crop varieties have disappeared in this century. Also, 80 percent of the horticultural fruit crop types in the United States have been lost. Moreover, in the United States, nearly 30% of the livestock and poultry breeds are candidates for extinction and 50% of the breeds in Europe have already become extinct (2000, p. 65). Batalion points out that using genetically engineered Bt crop will create Bt resistance in crops and this will lead to "losing natural pesticides" (2009, section 36). Therefore, governments must take precautions in order to avoid this type of situation. For all these reasons, it cannot be denied that GM crops harm society in various ways, affecting the farmers most negatively.

In addition to their impact on farming, GMOs also create ethical issues. As an example, their use leads to religious controversy. As stated by Priest, religious people express their feelings about genetic alteration by stating that it is just like "playing God" (2005, "Ethical Arguments", para. 3). According to Forman, religious laws do not allow people to insert genes from animals into plants. For instance, eating pork is not allowed in Islam and Judaism. Furthermore, genetic modification is challenging God according to some Christians

Since God put certain rules about how farming must be done, which is explained in the Bible. The Bible says that in one field, only one seed can be sowed and also animals can just be grown in a natural way so no animal can be bred with a different kind of animal. Therefore, religious people assert that GM is about mixing breeds and this is not allowed in the Bible and some accuse scientists of trying to be a creator like God (2009, p. 82). Raykova, Dziurawiec, da Viegua Mendes, Misiaszek and Savov indicate that manipulating the DNA of organisms leads to ethical problems because of the variety of people's views, beliefs and religions. For example, Christians believe that God is the unique creator and just God can transform life. Therefore, humans are not supposed to alter the DNA of organisms with scientific experiments. What is more, all of the religions have different rules about nature. In Hinduism, it is thought that the cow is a holy animal and for that reason, it cannot be harmed. Therefore, any genetic alteration to cows is disallowed (2009, p. 9). From the examples given above, it can be argued that genetic engineers should take religious factors into consideration while they are creating new organisms to avoid religious conflicts. For many valid reasons, genetically modified products should have explanatory labels on them saying they are GM products, but the fact that they do not have adequate labeling everywhere is another ethical issue. It is reported by Health Canada that there are not any special laws about the labelling of GM foods. As a matter of fact, all food products must apply the labelling rules of the Consumer Packaging and Labelling Act as well as the Food and Drugs Act. The labels must include correct information related to the product's content and safety (2009, "Labelling of GM Foods"). As explained in "Genetically Modified Foods", the government of Australia and New Zealand obliged producers to include information on the food item showing if the food is genetically modified or if it includes GM ingredients. They specified certain situations

where labels should be applied such as the inclusion of “new factor” which may lead to allergies, or in the case of unnatural toxins. Also, special labels are necessary if the food item may cause ethical, cultural or religious issues in terms of the genetic material that has been inserted (2008, “GM Labelling and the Law”). In view of all this information, it can be said that all governments should set up rules about labeling and the companies should comply with these rules. It can be concluded that the impacts of GMOs on society should be taken seriously to decrease their negative perception to a minimum.

To sum up, owing to the fact that utilization of GM crops results in harm to the environment, human health and society, GMO should be prohibited although it increases yield and product quality. The hazardous sides of GMO clearly outweigh its advantages. Firstly, Ethical and religious concerns arising from GMO are another critical aspect of their controversy, as is the need for strict labeling laws to protect consumer rights. Therefore, if use of GMO is proceeded with, it will cause irreversible results. Owing to this, a decision has to be made about prohibiting these products. If this sounds very unlikely, as a solution, after the production of GMO, they should be subjected to specific safety tests under the control of governments. Labeling is also an important issue. The labels of these products should be meticulously prepared so that the consumers are aware of the fact that they are modified foods and can choose not to consume them at all. However, if the labeling is not clear and specific enough to show that they are genetically changed, then some consumers will use them being unaware of the fact that they are modified, which is very unethical and unjust. With the help of further studies on GMO by researchers, serious risks of GMO will be better realized by people all over the world; therefore, more attention should be paid to this subject, and more research and investigation is necessary for the health of present and future generations.

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Beneficial Usage Fields of Nanotechnology

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### Abstract

Despite being a new branch of science, nanotechnology offers tremendous advantages in various fields. It surely has a promising future with many more applications and benefits to be discovered. One of its most common uses today is in the field of medicine. Nanotechnology brings practicality and safety to both diagnosis and treatment. Nanotechnology is also taking its place in different areas of industry such as the food industry, the automotive and aerospace industry. Economy, safety and improved functionality in various goods and products are some of the beneficial outcomes of using this technology. Moreover, nanotechnology provides new solutions to the energy problem by reducing energy consumption and providing environmentally-friendly energy systems. All in all, it can be said that nanotechnology is the “technology of the future” open for further developments.



### Beneficial Usage Fields of Nanotechnology

‘Smaller’, ‘cheaper’, ‘faster’ and ‘stronger’ have now become the slogans of the modern world. In order to lessen expenses and to make more profit, people are continuously inventing new techniques. Companies from all over the world are investing money and making researches aiming to thoroughly explore the potentials of new age technologies for the fabrication of materials and devices that contain more desirable properties and qualities. Many different and unbelievable discoveries are being made from day to day, making it difficult to track each one of them. Some prove to be useful while others do not. Among the useful ones, nanotechnology stands out. In the basic definition, nanotechnology means working at the molecular level and this brings numerous advantages to many fields (See Figure 1). In the past thirty years, nanotechnology has proven itself to be a very promising field, and today the application of nanotechnology is starting to show in a multitude of markets. There are still numerous potentials of nanotechnology for future benefits. Despite being a recent technology, nanotechnology is proving to be an indispensable part of life by offering many solutions and improvements in medicine, creating advanced materials in industry and providing opportunities for alternative means of energy.

The first significant application of nanotechnology is in medicine. To begin with, there are useful applications of nanotechnology in diagnosing techniques. In the past, quantum dots were used in diagnosis. However, as Bayer explains, they were complex and expensive in terms of their process and therefore, scientists looked for alternatives (2009, p. 40). At this point, nanophosphors seemed to have more efficient usage in diagnosis. Bayer explains that they were especially suitable for genetic and infectious diseases. Their advantage lay in the fact that their color did not fade out easily and their small diameter made it possible to

detect microscopic biological structures (2009, p. 40). As Bayer announces, “Experts discovered the new method by exploring the nanocosmos. They came across what are known as nanophosphors, a miniature form of the inorganic fluorescent phosphors used in lighting.” Blood, saliva, urine and hair are predicted to be probed more swiftly and in a more trustworthy way with the help of nanophosphors (2009, p. 39). Thus, one can say that nanophosphors are an improvement over quantum dots. Furthermore, cantilevers are efficient molecular detection tools for diagnosis (see Figure 2). Surendra (2007) asserts that semiconductor lithographic techniques are used to construct nanoscale cantilevers which are diminutive, elastic beams that look like a row of diving boards. Fast and impressionable detection of cancer-related molecules can be done by nanoscale cantilevers which are built as part of an ampler diagnostic device (“Cantilevers”, para. 1-2). The cantilevers are used in the human body to pick up various molecular expressions from cancer cells. When the antibodies combine with cantilevers, the cancer cell excretes its molecular product. Thus, the properties of cantilevers alter (“Cantilevers”, para. 3). This implies that cantilevers have made the diagnosis of cancer easy, safe and fast. Finally, nanoparticles can also be used as a diagnostic tool. As Surrendra explains, they enable scientists to detect cancerous cells at a very small size, which would not be possible to detect with conventional imaging methods (2007, “Nanoparticles”, para. 1-2). Clearly, that will lead to a reduction in the deaths caused by cancer as early detection saves lives. As a result, it is obvious from the above that the usage of nanotechnology in medicine provides efficient diagnosing techniques, which are very vital for patients with fatal diseases.

Apart from diagnosis, nanotechnology is also applied successfully in medical treatments. Most importantly, nanotechnology introduces “fresh perspectives” for cancer

therapy. According to Heath, Davis and Hood, cancer drugs' exposure to healthy tissues can cancer drugs. The small size of nanoparticles provides extra features for cancer therapy. It cures diseased tissues without harming the whole human body (2009, p. 49). This example shows that nanoparticles can eliminate cancer drugs' disadvantages. Also, nanoshells prove to be useful in cancer therapy. As Surrendra points out, nanoshells have a "core of silica and a metallic outer layer" and they tend to accumulate in cancerous lesions due to their small size. "Scientists can further decorate the nanoshells to carry molecular conjugates to the antigens that are expressed on the cancer cells themselves or in the tumor microenvironment."

Scientists can then provide energy for these cells. Nanoshells absorb this energy and convert it to heat, which results in the termination of the tumor cells (2007, "Nanoshells", para. 1-3). Thus, they will be the first choice of therapy in many cancer cases. Nanoparticles and nanoshells can be seen in Figure 2. Additionally, new promising nanomedicine products can be the key for fatal diseases. As emphasized by The Institution of Mechanical Engineers, the most surprising inventions in medicine have been presented by nanotechnology. Effective tools which can be used on a subcellular level for the treatment of human diseases have been developed by nanotechnology. Biomaterials which have been invented in recent times using nanostructures, will develop the biocompatibility of medical materials and implants. As a result of investigating nanotechnology, it can be seen that treatment methods have been found for some diseases owing to nanocoating on surfaces, active surface fictionalization and nanofibre devices. Surgeons hope that cell-surgery materials will contribute to curing at a molecular level. Nanotechnology will make many more utilizations possible in the future, with rejection-resistant artificial tissues being one significant target. Then, scientists will be able to make, for example, the smallest pace makers for the heart or retinal and hearing

implants using micro-nano techniques (n.d., para. 6-7, 9). In the light of all this explanation, it can be said that nanotechnology will mark an era in the medical sector. In brief, nanotechnology provides new treatment methods through nanodevices for diseases and this is a promising field of development.

The second outstanding usage field of nanotechnology is in industry. To start with, nanotechnology can be applied to the food industry. Most importantly, nanotechnology can modify food processing methods. “On-demand” foods can be given as an example. Joseph and Morrison state that the influence of nanotechnology can be observed in the interactive food which can transfer nutrients conveniently and answer to the body’s demand. The conception is “on demand” food, which means that thousands of nanocapsules including flavour or colour enhancers or added nutritional elements such as vitamins and minerals, remain inactive in the food and can only be used when required by the consumer. All these improvements will supply various advantages involving enhanced energy, developed cognitive functions, more improved immune function and antiaging advantages (2006, p. 10). Some companies add nutrients to their products with nanotechnology. Thomas and Morrison state that Nutralease achieves this by incorporating nanosized particles to cells. These nutraceuticals vary from beta-carotene to lutein, or from lycopene to phytosterols. Also, some bakeries in Western Australia have incorporated tuna fish oil in their bread. The microcapsules burst open when they reach the stomach, and in this way, the user avoids the unpleasant smell of the fish oil (2006, p.10). Miller and Senjen assert that Aquanova, which is an industrial sausage and cured meat company, has improved a nanotechnology-based carrier system. Vitamins C, Vitamin E and fatty acids which are active ingredients are encased in this system later to be made use of in preserving and aiding nutrients (2008, p. 12). In

addition, bioavailability is another advantage the food industry will gain from nanotechnological applications. As Mozafari et al. cited in Miller and Senjen explain, nanosizing or nano-encapsulating active ingredients offers? a higher bioavailability (2008, pp. 13-14). Other useful characteristics can be added to foods, increasing their shelf life. Miller and Senjen mention that nanoparticles which unite carefully with many foods develop flow features, colour and perseverance during processing, and raise shelf life (2008, pp. 12-13). Most of the food giants support specific research programmes to further enhance the abilities of food and it is obvious that not only food companies but also consumers will benefit from nanotechnology. Moreover, another application of nanotechnology within the food sector is in food packaging. Joseph and Morrison state that nanotechnology provides improvement in the barrier functions of foods making them more resistant to environmental conditions such as heat or moisture, also alarming the consumers in case of contamination. Smart packaging systems, which tell if the product is fresh or not are already being used by many companies such as Kraft food, which come with nanosensors that alarm the consumer when the food is spoiled. Bayer polymers developed packaging which provides moisture and oxygen to prevent the spoilage of foods. Companies like Voridan or Miller are using nanocomposite bottles which are lighter but stronger. Kodak has developed an antimicrobial film which prevents spoilage, and researchers at the University of Bonn are working on dirt repellent nanocoatings for packages of foods (2006, pp. 7-8). Also, monitoring and tagging of food items will be possible with RFID technology. Joseph and Morrison assert that RFID will be a very practical implementation of nanotechnology in tracking food (2006, p. 8). Additionally, as Miller and Senjen indicate, edible nanocoatings are a revolution in the food industry. These coatings cannot be seen with the naked eye as they are too thin. They are mostly used in the packaging

of meats, cheese, fruit, vegetables, confectionary and bakery. They both add barrier functions to the food while also increasing their shelf life (2008, p.15). Taking all these advances into consideration, one can clearly see how positively nanotechnology will affect the food industry. All these examples definitely prove that nanotechnology provides revolutionary and beneficial opportunities for the food industry.

Aside from the food industry, nanotechnology also provides beneficial usage areas in both automotive and aerospace industries. For example, nanotechnology offers new perspectives for the automotive sector. The Frost and Sullivan Research Service (2004) claims that nanotechnology is very important in order to provide cost-effective, high-performance materials, safe and recyclable materials in the world automotive market. If nanobased materials are used instead of the expensive platinum in fuel cells, those cars will be more environmentally-friendly. The effect of nanotechnology in the future is considered in three principal sectors by The Frost and Sullivan Research Service. These principal sectors are energy generation and storage; materials; and electrical and electronics. When the situation is examined in terms of strategy, nanotechnology can articulate the market strategy and offer new recommendations. It is thought that nanomaterials are utilized to get high performance and this costs very little. For example, instead of three layers, a single layer is produced by nanotechnology. As a result of this, money is saved. This research includes the new technologies which are nanocomposites, quantum dots and nanolithography (para. 1, 2, 3, 14). As reported in the article “Nanotechnology-Based Lubricants” (2009), nanolub is a product of nanotechnology and it offers many advantages. For instance, it develops the compression efficiency and lessens fuel consumption by 5% and decreases engine temperature and noise. Also, it provides energy and financial savings and is environmentally-

friendly. The research of The University of Newcastle in England and The University of Stockholm showed that gear wear can be diminished by 5-6 times by a nanolub which is a film on the surface of the metal that preserves it (para. 1, 2, 6). Increased safety of materials will be another asset. As Birch explains:

Nanotechnology is already playing a part in vehicle safety, particularly in military applications. Nanotubes' heat-transfer properties are such that a gasoline tank containing them will not catch fire when exposed to a naked flame. This is particularly significant for military vehicles; a fuel tank containing nanotubes in open sphere configuration (taking about 4% of capacity) will not explode even if a bullet passes through it. (2009, "Enhancing Safety", para. 1)

Considering all the information above, it can be said that scientists should investigate more about nanotechnology and governments should support them since nanomaterial products help the automotive industry to develop. Also, the aerospace sector can progress with nanotechnology. Fidelus, Lewandoska, Bielinski and Malsch (2007) explain the usage of PNCs - polymer nanocomposites or polymer nanostructured materials as follows, "Their application brings improvements in mechanical strength and aging resistance, reduction of wear and flammability, barrier to diffusion, optical transparency, and unprecedented morphologies such as interpenetrating networks." (p. 22). They state that improvements in terms of ductility and superplastic behaviour as well as corrosion and wear resistance can be achieved with nanotechnology (p. 18). In addition, Meyyappan asserts that carbon nanotubes are very popular in the aerospace industry as they improve strength with lower weight (2007, para. 1-2, 4). Fidelus et al. foresee that in the coming years, nanocomposites will advance in efficiency and will cover more usage fields in engines, energy and electronics systems, which

will result in saving money and time while also reducing pollution. During this process, scientists and engineers will find ways to add new functionalities to materials. For example, materials with less tendency to form ice will prove to be beneficial in aircraft wings. It is expected that any kind of improvement in nanotechnology will result in affecting other industrial areas (p. 114). Research thus shows that nanotechnology can be advantageous for many industries such as the automotive and aerospace in numerous ways. Taking all these facts into account, it can be seen that nanotechnology is quickly becoming a part of people's lives, becoming more and more useful, and giving chances of advance in many fields, far earlier than could be imagined.

The third remarkable utilization area of nanotechnology is in energy. Above all, energy consumption can be reduced by nanotechnology. For example, nanotechnology offers more efficiency in photovoltaics. Jenkins states that quantum dots can be utilized in producing significantly thin but efficient PVs. He explains the quantum dots as follows, “tiny nano-scale (generally smaller than 10 nanometers) semi-conductor crystals of materials like Cadmium-selenide (CdSe) or Lead-selenide (PbSe) ... have huge potential for photovoltaic applications because, as semiconductors, they can, like the silicon in traditional PVs, absorb photons from solar radiation and release electrons to generate electricity” (2005, para. 2-6). Thus, it is clear that nanotechnology research will help the energy sector to advance to a great extent. Moreover, nanotechnology also helps to provide increased efficiency in fuel cells. In the article “Energy Applications of Nanotechnology” (2007), it is stated that one important problem in energy production is the fact that some energy is lost due to the generation of heat as a by-product as in the example of the internal combustion engine. Nanotechnology appears to be a viable solution at this point. As



explained in the article :

In order for a fuel cell to operate, particularly of the hydrogen variant, a noble-metal catalyst (usually platinum, which is very expensive) is needed to separate the electrons from the protons of the hydrogen atoms. However, catalysts of this type are extremely sensitive to carbon monoxide reactions. In order to combat this, alcohols or hydrocarbons compounds are used to lower the carbon monoxide concentration in the system. This adds an additional cost to the device. Using nanotechnology, catalysts can be designed through nanofabrication that are much more resistant to carbon monoxide reactions, which improves the efficiency of the process and may be designed with cheaper materials to additionally lower costs. (para. 1-3, 9-12)

All in all, it is clear that people who use nanotechnology-based fuel cells will be able to utilize electrical goods when there is a long power cut. Research thus shows that nanotechnology can be advantageous for providing efficiency in energy consumption.

In addition to the reduction of energy consumption, nanotechnology also has significant superiority in revolutionary environmentally-friendly energy systems. For instance, nanotechnology offers a solution to the mercury problem in broken bulbs. Randhawa (2008) declares that due to health concerns about mercury vapour exposure after compact fluorescent lamps have broken, integrated nanoparticle coatings are applied to improve the assimilation of mercury. CFL's working principle is based on electricity to produce a current through mercury vapour. This raises mercury atoms to a higher energy level, providing ultraviolet light that then causes phosphor, supplying visible light. Compared to incandescent bulbs, CFLs produce 75% less power while surviving up to 10 times longer. Integrated with selenium particles a plastic bag has been devised by The Brown University

team, in which old bulbs can be stored. As of 2012, the US will produce no more incandescent bulbs and alternate them with CFLs (p. 14). All these examples lead to the fact that CFLs will be used as energy saving alternatives to incandescent lamps with the contribution of nanoparticles. What is more, nanotechnology helps to improve the battery technology. In the article “Revolutionary New Nanotechnology”, it is pointed out that A123’s revolutionary technology will make it possible to advance the performance of portable devices, releasing them from their dependency on power cords and sockets, all thanks to the nanotechnology-based lithium-ion batteries (2005, para. 3). The batteries can charge themselves up to 90% capacity just within 5 minutes (para. 7). Also, McClellan gives the example of Altair nanotechnology battery. It is proven by tests that the battery can overcome high electrical currents with insignificant loss of energy, leading to higher efficiencies. This is because of the low resistance of the battery (2008, para. 1-2, 20). Front Edge Technology Incorporation (2008, “The World’s Thinnest Rechargeable Battery”) also offer solid-state micro-batteries [as thin as 200 microns], which are bendable and thus provide physical flexibility in various sizes and shapes (see Figure 3). Therefore, people will soon have new and vast opportunities in science, particularly, in the energy field of creating new, cheaper and more efficient systems of energy supply, which may lead to an easier life. All these examples prove that nanotechnology offers new environmentally-friendly energy systems.

In conclusion, medicine, industry and energy are areas which have efficiently utilized nanotechnology. In spite of being newer than other technologies, nanotechnology revolutionizes medical diagnosis and treatment methods. It also brings fresh opportunities for food industry as well as automotive and aerospace industries. In the mean time, it offers environmentally-friendly energy systems in order to save energy. For all these reasons,

nanotechnology which is being used everywhere for various purposes will soon become cheaper so that it can be used easily in everyday life. This should motivate scientists to study nanotechnology more intensely. Also, government and private corporations should support and provide scientists' demands for these studies. Consequently, the growing realization of the significance of nanotechnology will spark a lively competition between developed countries in the area of nanotech manufacturing technologies in the near future.

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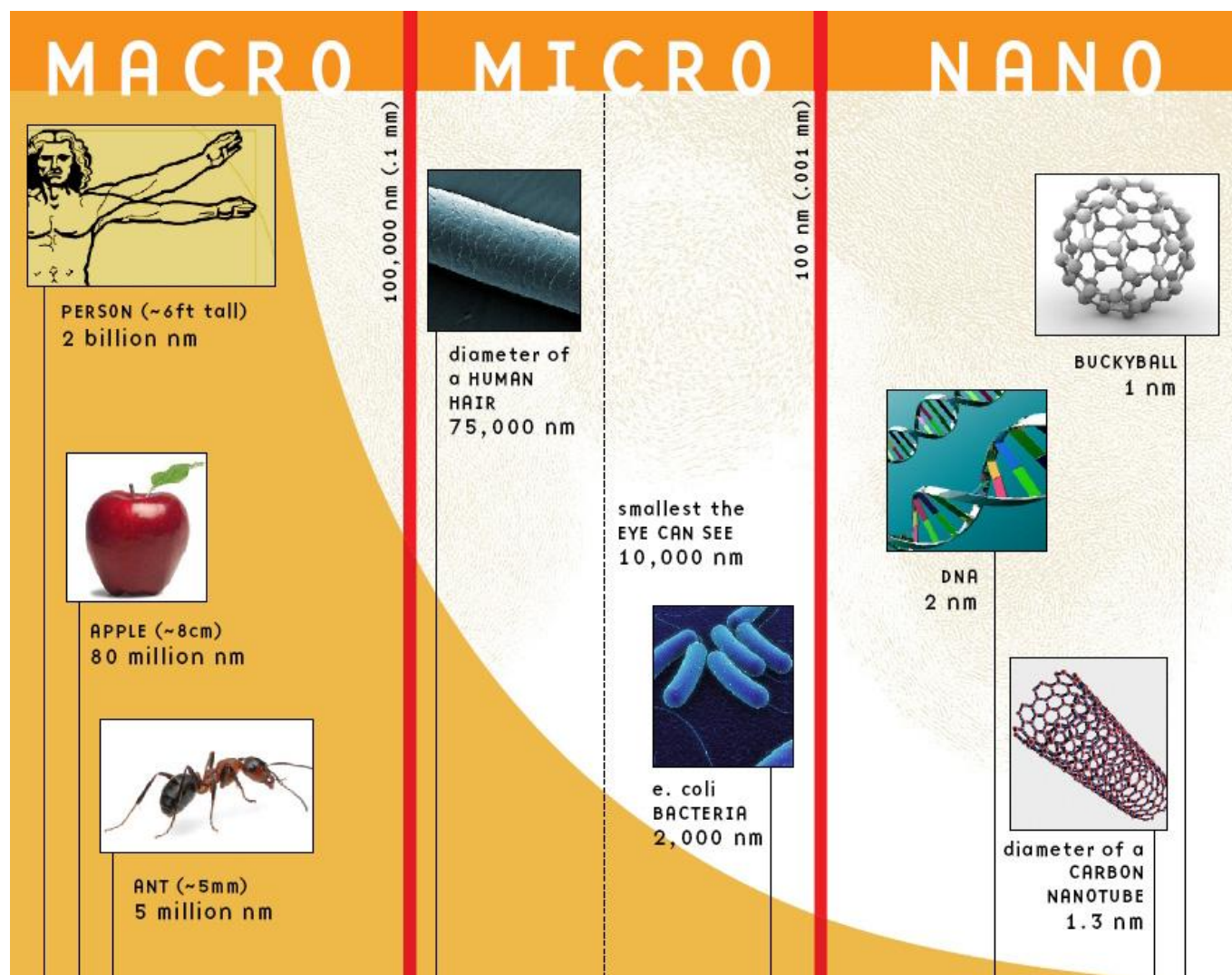
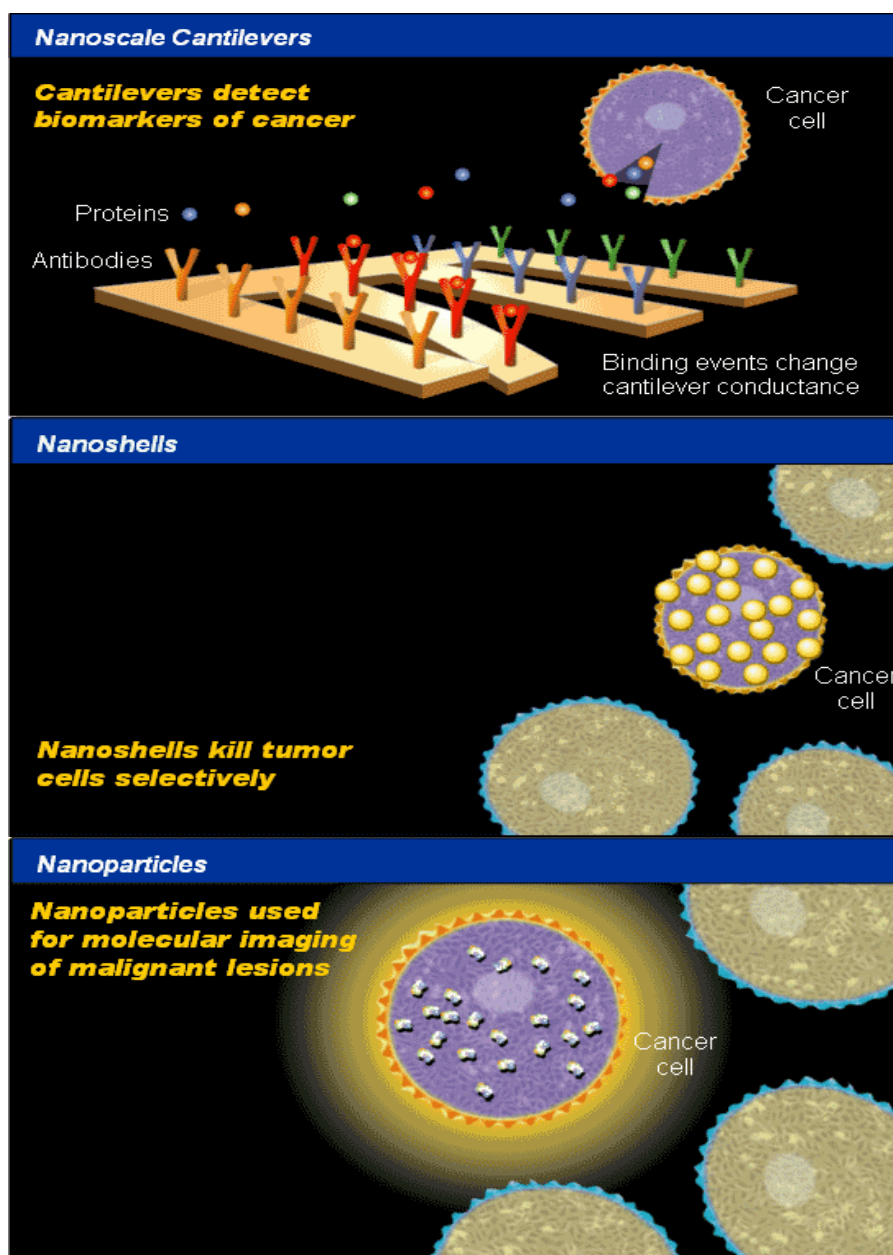


Figure 1. The images show a comparison between macro, micro and nano levels.

From “Regulating emerging technologies in Silicon valley and beyond” by Silicon Valley Toxics Coalition [SVTC], 2008, Copyright SVTC.



*Figure 2.* The images show three kinds of nanotechnological tools used in medicine, namely cantilevers, nanoshells and nanoparticles. From “Understanding nanotechnology” by Majumdar, Neuwelt & West cited in National Cancer Institute. n.d. Copyright the National Cancer Institute.





*Figure 3.* The figure shows FET's solid-state micro-batteries [as thin as 200 microns], which are bendable and thus provide physical flexibility in various sizes and shapes. From "NanoEnergy® - The power for micro devices: The world's thinnest rechargeable battery" by Front Edge Technology, Inc., 2008. *Copyright* 2000-2008 Front Edge Technology, Inc.

AK-47: The People's Choice

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### Abstract

The AK-47 began as the winning entry in a competition for a Soviet assault rifle and its simple, tough design has ensured its reputation for reliability. In action, the choice of 7.62 mm ammunition has made it a very effective weapon, particularly when combined with its ability to withstand adverse conditions without careful maintenance. It is simple to use and has only eight moving parts, which also makes it easy to mass-manufacture. It is widely available, cheap and adaptable, and its use by many different individuals and organizations has lead to its iconic status. Due to its influence on the arts and its widespread use in merchandising, it has become one of the most easily-recognized and influential objects in the world.

### AK-47: The People's Choice

Warfare has always been a stable part of human history. There has been conflict at every stage of “civilization”, and there is no evidence to support the belief that this situation will change at any time soon. However, it is also true that such times of desperation often act as hothouses for ideas and technical progress despite their obvious and tragic consequences. The aeroplane, for example, was first flown at the beginning of the last century, but by the end of World War II the jet-age had already begun and the foundations for the space-age had been prepared. The same is true for medicine, an area in which wartime opportunities for research into battlefield injuries brought great advances in emergency treatment, plastic surgery and prosthetics. Occasionally, however, some things designed specifically for war become not only successful in their own field, but take on an iconic new life in which they come to represent much more than their basic purpose. The AK-47 has become such an icon; all around the world, its shape is easily recognized, its function is widely understood and its symbolic significance is reflected by the use of its image on national flags, T-shirts and countless items of merchandising. Designed according to principles established in World War II, the AK-47 has since become the world's most successful weapon not only because it is physically robust and reliable, but also due to its huge levels of availability which have given it a unique and iconic status in popular culture.

As its name suggests, the *Avtomat Kalashnikova* dates back to 1947, when Mikhail Timofeyevich Kalashnikov's design won a competition to decide the Soviet armed forces' new weapon. However, the decision to produce a rifle that was also capable of fully-automatic fire has its origins in the lessons learned following the invasion and huge advances

into Russia made by the German army in 1941. The German arms industry had previously developed the MP-40 (*Maschinenpistole*), a personal soldier's weapon that was capable of firing 500 rounds per minute, and which was manufactured with extensive use of pressed metal and spot welding to reduce time and production costs (Miller, 2001, pp. 356-357). The advantages of such a mass-manufactured weapon that was so well-suited for the more modern, close-range, fast-moving *Blitzkrieg* style of mechanised warfare were considerable, especially when troops could use their collective fire against enemy positions to devastating effect. The Russian army, however, was still dependant on weapons such as the semi-automatic, complex and difficult to manufacture Tokarev SVT-40 rifle (*Samožaryadnaya i avtomaticheskaya Vintovky sistemi Tokareva*), a situation that was not made easier by supply shortages caused by the continuing conflict and the low manufacturing standards in both weapon and ammunition factories (Miller, 2001, pp. 302-303). These poor-quality rifles were unable to answer the rate of fire or reliability of the German weapons and the Russian soldiers armed with them clearly needed a replacement.

Eventually the situation on the front-line caused a change at the very top of the Soviet system. In 1941, Stalin reversed an earlier decision to concentrate on the manufacture of rifles and carbines, and ordered instead the mass production of the PPSH-41 sub-machine gun (*Pistolet-Pulemyot Shpagina*), a practically unbreakable weapon which could fire 900 rounds per minute when switched to fully-automatic, but which did not require any screws or bolts to manufacture as it was made from stamped, riveted and welded metal parts with an unfinished wooden stock and fore-grip (Hodges, 2007, pp. 38-46). This simple approach allowed easy mass-manufacturing, and is undoubtedly one of the reasons why this weapon with its distinctive drum magazine can be seen in many of the photographs of the Red Army in action.

The PPSH-41 was so successful that in total over 5 million were made, and eventually entire battalions were equipped with them as Soviet mass-production and supply systems became more organized (Miller, 2001, p. 369). The availability of so much firepower eliminated the close-range advantages of the MP-40, and put both sides fighting on the Eastern Front on an equal footing, at least in terms of small-arms; this could only result in a race to develop a new and improved type of personal weapon.

The MP-40 and PPSH-41 were both sub-machine guns. This meant that they were effective enough at close quarters, but like all weapons of this type they were limited in terms of accuracy and range. In response to these short-comings, German weapon designers began to look for ways to combine the benefits of the longer range, more powerful rifle and those of the rapid fire machine gun. They eventually managed to accomplish this with the MP-44 which could fire 500 rounds per minute, but which also had a longer barrel length of 420mm and a muzzle velocity of 647 m/sec, compared with the 251mm barrel and 365 m/sec muzzle velocity of the MP-40, and the 269mm barrel and 489 m/sec muzzle velocity of the PPSH-41 (Miller, 2001, pp. 270, 356, 368). The longer barrel and higher muzzle velocity of the MP-44 made it capable of ranges and levels of accuracy that could not be matched by a sub-machine gun, while keeping all the advantages of selectable fully-automatic fire. It was, in fact, the first example of a completely new category of weapon. Adolf Hitler himself is said to have called it a *Sturmgewehr*, which is the first recorded use of the term “assault rifle” (“Machine Carbine Promoted”, 1945, para. 1). Unfortunately for the Germans, the MP-44 (also later known as the StG-44) was too late to change the course of the war, but its superiority over both the standard rifle and the sub-machine gun were obvious to the Soviet military, against whom many of them had been used.

The MP-44 was clearly a superior type of weapon, and “assault rifle” describes it perfectly. To find a weapon that could equal its capabilities, the Soviet People’s Commissariat on Armaments launched a competition for assault rifle designs in 1943, but it was not until 1947, two years after the end of the war, and also after many difficult tests that included being dropped from a height, immersed in water and dragged through sand barrel-first, that Mikhail Kalashnikov’s entry was finally declared the winner due to a faultless performance that was concluded without a single jam or misfire (Hodges, 2007, pp. 49, 51). Although the AK-47 bears a strong outward resemblance to the MP-44, largely because of its similarly banana-curved magazine, and shares the same use of tapped-gas from the barrel to drive a piston to push the bolt carrier back against the return spring, Kalashnikov himself claims to have never seen any captured German weaponry, despite working in Russian weapon development centres that must have held examples (Hodges, 2007, p. 49). However, his claim is strengthened by an examination of the internal workings of the AK-47. Its firing mechanism is actually much more similar to the 1936 model American Garand M-1 rifle, with the same bolt and lock design, although Kalashnikov’s design takes its gas supply by means of a tube over the barrel, whereas the M-1 has a feed below (Gunweb, n.d., “Descendants”). Despite appearances and the obvious external similarities, this crucial internal difference means that the AK-47 cannot be said to be a mere copy of the German weapon.

The Soviet Union had a very large and diverse geography, which logically dictated that a weapon must be robust and reliable enough to operate reliably in extreme temperatures and in all manner of conditions. To meet these challenges, the AK-47 was designed with a total of only eight moving parts and enough latitude in its specifications to still be functional even after being left to soak in mud (Hodges, 2007, pp. 28, 29). Such reliability is obviously

an advantage for any group needing to leave their weapons hidden or buried for lengthy periods of time, or in situations where conditions are not suitable to break the weapon down to clean it. This became a major factor in the Vietnam conflict where the main rival of the AK-47, the American Armalite AR-15/Colt M-16, quickly gained a very poor reputation among soldiers for its tendency to jam. 80% of the American soldiers canvassed in 1967 complained of their weapon's failure to fire, and in another case one US Marine said "We left with 72 men in our platoon and came back with 19...Believe it or not, you know what killed most of us? Our own rifle. Practically every one of our dead was found with his [M16] torn down next to him where he had been trying to fix it" (Chivers, 2009, para. 6; "Defence: Under Fire", 1967, para. 2). The unreliability of the M-16 was largely due to a lack of chrome plating in the firing chamber, which lead to rust; the non-supply of cleaning kits, which produced a belief that the weapon did not require cleaning; and the use of a type of propellant in the ammunition that eventually jammed the firing mechanism, and continued until these deficiencies were rectified (Miller, 2001, p. 204; Kahaner, 2006, p. 2). The AK-47 did not suffer from the same problems. It was manufactured from the start with chrome plating not only for the chamber, but also for the gas piston and cylinder, which greatly extended its operational life and reduced the need for careful cleaning (Hodges, 2007, p. 50). Even in more recent conflicts, the AK-47 has maintained this superiority in the face of more modern weapons. The dust, sand and high temperatures in Iraq and Afghanistan have proved to be very difficult for even the latest generation of M-16 to deal with, again resulting in failures to fire (Chivers, 2009, para. 9). All of these points illustrate the technical superiority provided by Kalashnikov's simpler, more basic design, and demonstrates that any weapon that requires less careful and complicated field maintenance is certain to be more well-regarded and



is also more likely to keep its users alive.

Despite its operational simplicity, the AK-47 is still a very effective weapon. It has a muzzle velocity of 717m/sec, can fire 600 rounds per minute from a 30-round magazine, and its 415mm barrel gives it an effective range of approximately 300m, even though it tracks slightly to the left when fired on its fully-automatic setting (Miller, 2001, p. 262; Hodges, 2007, p. 28). The M-16, by comparison, has a barrel length of 508mm, a muzzle velocity of 991m/sec and can fire 800 rounds per minute, again from a 30-round magazine (Miller, 2001, p. 202). On paper, at least, the M-16 appears to be superior. However, any extra length means that a weapon will take longer to bring to readiness and will also be more difficult to use from inside a vehicle or from behind cover. Another point is that the AK-47 uses 7.62 mm ammunition, whereas the M-16 has a calibre of 5.56 mm (Miller, 2001, pp. 202, 262). Heavier ammunition equates to greater damage, which is the ultimate purpose of any such weapon, and can allow it to be used against targets that would otherwise be protected. Despite the M-16 being lighter and more accurate due to its higher muzzle velocity, the heavier calibre of the AK-47 gives it much more destructive capabilities that enable it to destroy cover or protection such as masonry more easily (Ishnin, n.d., "Firepower"). Ammunition is also important in another, more crucial way. Although interviewed Iraqi soldiers equipped with M-16s considered them superior in terms of accuracy compared to the AK-47, they feared an ammunition shortage after the departure of the American forces (Al-Jawoshi, 2009, para. 2-3). The fact that the AK-47 has long been produced, either legally or illegally, in countries such as those from the former Warsaw Pact and China makes finding sufficient ammunition a non-issue. Estimates of the total number of AK-47 variants produced are between 70-100 million, compared with only 7 million M-16s ("AK-47: Iconic Weapon", 2005, "Illicit Exports").

If true, this would mean that there is one AK-type weapon for every 60 people in the world: two magazines' worth, to put it in AK terms. Such high numbers clearly demonstrate the high demand for this weapon, and imply the ready availability of spares and ammunition.

It is also clear that an effective weapon is also one that can be used without needlessly endangering its user, and here too the Kalashnikov's design gives its users a deadly advantage. When comparing the AK-47 to the M-16, it can be clearly seen that there is a straight sighting line all the way along top of the Kalshnikov whereas the Colt has a raised tailsight that also acts as a carrying handle. The obvious consequence of this is that anybody aiming the M-16 must raise their head further above cover, thereby offering more of a target to the enemy (Miller, 2001, p. 269). The fact that the M-16 is still the standard arm of the US military demonstrates that it is regarded as being very good weapon in its own right. However, their long rivalry in conflicts around the world has shown the AK-47 to be more effective overall. It has been claimed that 250,000 people are killed every year by Kalashnikovs, and these ever-increasing numbers are already far more than the 200,000 casualties from the two nuclear detonations at Hiroshima and Nagasaki (TV-Novosti, 2009, para. 8; Atomic Archive, 2011, "Total Casualties"). For all the strategic arms limitation talks, international nuclear weapon treaties and boycotts of aspiring nuclear states, the AK-47 is a real weapon of mass destruction.

Of course all weapons depend on the ease with which they can be used and supplied, the numbers and price at which they can be purchased, and their level of adaptability to appeal to greater numbers of potential users. With so few moving parts, the AK-47 is simple to take to pieces for cleaning or repair. It is shorter than a carbine rifle, the cocking handle is easy to operate, and there is a large lever to select single-round or fully-automatic fire as well as a

pistol grip with an oversized trigger guard which makes it possible to fire while wearing gloves (Hodges, 2007, pp. 26-27). These features and attention to detail allow easier and more convenient usage without making the weapon more complicated, which would increase both manufacturing and training times. Hodges (2007) reported that during the war in Vietnam, men, women, boys and girls were quickly taught how to use Chinese-made Norinco type-56 copies that were delivered in such high numbers along the Ho Chi Minh trail that American forces resorted to using carpet-bombing and defoliation with Agent Orange in an attempt to stop the supply. Not even this extreme measure was successful, as the North Vietnamese Army and Vietcong gradually pushed the outgunned American forces back and out of the country. The pattern of attempted disruption of supply was repeated during the Soviet occupation of Afghanistan during which the Red Army cleared the vegetation to the Kalashnikov's maximum effective distance of 300m at either side of their supply roads to prevent their own arms convoys being captured and used against them by the mujahideen (pp. 55, 56, 103). It is probably fair to say that no other small-arms have ever had such a geographical effect.

The huge worldwide supply of these weapons, and the inevitable consequences of their usage has undoubtedly resulted in cheaper prices. Following the 2003 invasion of Iraq, the entire stockpile of Iraqi Army AK-47s disappeared and many of them were subsequently sold on for \$100 each, significantly increasing the total number of available weapons in the country (Hodges, 2007, p. 172). Elsewhere, \$100 would be considered too expensive for the market conditions. In some countries it is reported that an AK-47 can be exchanged for a bag of rice or for as little as \$20, and in some cases a Kalshnikov can be bought for less than the cost of a live chicken; it has also been nicknamed "the African credit card – you could not

leave home without it” (Blagrove, 2006, para. 7; Kahaner, 2006, pp. 1, 2). However, it is worth remembering that when a combatant is killed, captured or injured, their weapon can be passed on to another. In such cases there is no requirement for constant resupply with factory-fresh stocks, as old guns are recycled through each new generation of fighters. The low cost of the AK-47 can be illustrated by the fact that it has become such a popular, cheap and available item in the stockpiles of international arms-dealers that the producers of the 2005 Nicholas Cage film “Lord of War” found it more cost-effective to rent real weapons rather than more expensive movie-prop blank-firing versions (iMDb, n.d., “Trivia”). Given the economic circumstances of many of the countries where the AK-47 is widely used, its low comparative price and easy availability definitely give it a competitive advantage over more modern and expensive alternatives.

Since its beginning, the AK-47 has continued to expand into almost every area of conflict, including those involving acts of terrorism, and seems to have become the default choice in many parts of the world as it easily lends itself to being adapted for different uses. Photo-journalist Pierre Bullant illustrated this point by explaining that regular fighters in Palestine use the full-length rifle, whereas security police saw off the wooden stock to be able to carry the weapon in the door pocket of a vehicle (Hodges, 2007, pp. 105-106). This, of course, makes the weapon much less accurate as it cannot be aimed properly from the shoulder, and makes standing anywhere in front of a person using one extremely dangerous. However, even fired from the hip, the AK-47 would still do considerable damage in a close-range fire-fight, and its deadly reputation is also an undoubted asset that can be used to intimidate any potential opponents. To avoid the need for such drastic modifications, however, there is also a factory-made variant with a folding metal stock which reduces the

weapon's overall length from 870mm to 645mm (Global Security, n.d., "Characteristics"). This version was used in the infamous attack at the 1972 Munich Olympic Games, when eight members of the Black September organization smuggled their weapons into the Olympic village in duffel bags and used them to kidnap and kill eleven Israeli athletes and coaches; five of the terrorists and a West German police officer were also killed later during a failed rescue attempt (Chivers, 2010, p. 3; Spencer, 2010, para. 3). The relatively shorter length offered by the folding stock makes this version of the AK-47 an almost inevitable choice for this type of operation, as these factors allow it to be carried hidden under a coat or in a sports bag and still be easily deployed while remaining equal to the effective range of almost any weapon used against it. However, it must be pointed out that any weapon that can still be used effectively despite having major components sawn off is clearly one to be taken seriously.

The huge supply, low price and adaptability of the AK-47 have allowed it to dominate the international small-arms market. In total, the official forces of more than 50 countries use its variants or licensed copies (Global Security n.d., "AK-47"). As this figure does not include irregular, unofficial or illegal use, the actual number must be much higher, and there is apparently almost no end to the situations, conflicts and dramas that the AK-47 has been a part of. For example, Salvador Allende, president of Chile reportedly committed suicide with the AK-47 that was sent to him as a gift by Fidel Castro during General Augusto Pinochet's 1973 coup d'état, although this long-held verdict has recently been thrown into doubt by alleged autopsy traces of a second, smaller weapon found among the ruin left by the 7.62 mm calibre bullet (Yapp, 2011, para. 7, 8, 11). In 1981, Anwar Sadat of Egypt was assassinated by his own soldiers carrying Egyptian-made copies; in Africa, the Ugandan warlord Joseph Kony armed an entire army of abducted children with AK-47s in 1987, Hutu militias used them in

Rwanda in 1994, and guerrillas in Mozambique have been equipped with weapons supplied by East Germany, North Korea and Cuba since 1964; the massacres of the Kurds in Iraq and the Bosnians in Srebrenica were carried out by forces armed with the AK-47; and in 2006, Hugo Chavez of Venezuela dramatically increased international tensions by purchasing 100,000 rifles and a manufacturing license (Chivers, 2010, p. 3). This final development is the first time production has occurred in the Americas and could be said to be a major step in guaranteeing continued supplies of the AK-47 across the western hemisphere. Combine this with the already well-established factories in Eastern Europe, Russia and China, and the future of the AK-47 looks secure.

All of these factors, and even though some of them are clearly terrible, have brought the AK-47 a truly iconic status. It has become an official symbol of government, and has outlived several its most famous associates. It is a constant actor in the media coverage of many areas of conflict and it has come to have a powerful influence on the arts and youth culture. The Kalashnikov's iconic status is probably best defined by the use of its image by governments and organizations. It is depicted on the national flag of Mozambique, where it is possible to say that the gun is internationally better well known than the name of that country's president (currently Armando Guebuza). Attempts to have it removed from the flag in 2005 ended in failure ("Mozambique Shoots down New Flag", 2005). It also appears on the Zimbabwe coat of arms and more prominently on the flags and banners of Hezbollah, where the Arabic letters that make up the name of that organization reach up to grasp the gun. In total, six countries have a representation of the AK-47 on their official seals (Global Security, n.d., "AK-47"). Whether setting-up or tearing down a system of government, the AK-47 often remains the tool of choice.

Individuals have also come to be closely associated with the AK-47. The many photographs and video films of Osama Bin Ladin were not often without his AK-47 either in his hands or positioned carefully somewhere beside or behind him. This was the same gun that he allegedly won in combat from a Russian soldier (Auster, 1998, para. 1). Saddam Hussein is another well-known figure to become part of AK-47 history. After coming to power in Iraq in 1969, he soon made agreements with both China and Yugoslavia to import Kalashnikov copies: the Chinese model-56 and the Yugoslavian Zastava M70B1 (a copy of the folding-stock AKM variant), and Iraq later began manufacturing the Tabuk, their own copy of the M70B1 (Hodges, 2007, p. 172). After its service against Iran and in the first and second Gulf wars, Saddam remained loyal to the weapon until the end. When he was caught in 2003, he was found to be in possession of a pistol, a set of documents, \$750,000 in \$100 bills and two AK-47s (“How Saddam Hussein was Captured”, 2003, para. 11, 25). Even seven years later, his association with the weapon was still not finished. In 2010, Corinne Sawers, the 23 year-old daughter of the head of the British Secret Service MI6 caused a minor media scandal when she posted a photograph of herself holding what is believed to be a gold-plated and deactivated Kalashnikov from Saddam Hussein’s private collection on her Facebook page; her father had received it as a present when he was stationed in Baghdad and had taken it home in 2003 (Taylor, 2010, para. 1-2). Throughout its history, the connection between the AK-47 and individuals of whatever station has always proved to be better for it than for them. This does not, however, seem to lessen its popularity.

These high levels of appreciation have been repeated in the United States, and for this the AK-47 owes much to its connection with “outlaws”; a group that have always held a fascination for the more law-abiding members of American society. It is not the first to have

achieved this, the 1921 model Thompson “Tommy-Gun” is still a stock image of the 1920s Chicago and New York Mafia, the Untouchables, prohibition and Bonny and Clyde. Nor is it the only example, the infamous street gangs of Los Angeles, which even in 1987 had as many as 50,000 members and were behaving more like armed militias, are still well-known to favour smaller sub-machine guns such as the Uzi 9 mm and Ingram M-10 / MAC-10 in addition to the AK-47 (Armstrong, 1987, para. 7, 8; Everett Police Department, n.d., “Weapons”). However from a historical perspective, the popularity that the AK-47 has achieved with American criminals means that it now regularly faces law-enforcement agencies using variants of the Colt M-16 in a homeland urban replay of the Vietnam conflict. In 2003, young men armed with AK-47s and fuelled by crack cocaine sprayed bullets at each other and anyone nearby from moving vehicles around one seven-block area of New Orleans, and across America the weapon’s iconic value is still regularly upheld by its users openly and habitually displaying its distinctive profile to their opponents (Hodges, 2007, p. 215). To many, it is undoubtedly a status symbol that demands respect for the person carrying it, and perhaps inspires others to follow their example by the way that their actions are reported in the media, which regularly uses the AK-47 as a stock and arguably glamorous image of conflict and rebellion (Cramer, 1993, para. 1-5). Given the photogenic nature of urban combat, and the allure of images of dangerous events that are shown on television, in newspapers or on the Internet, the distinctive and easily-identifiable AK-47 is almost guaranteed an audience whenever security forces or police engage groups of rebels or armed criminal gangs. Every outrage, massacre and death that occurs in front of the camera, and which is then endlessly repeated throughout the 24-hour news cycle, merely cements its reputation.



Away from the carnage on the television news, the AK-47 has also gained influence away from mass-media news reporting and those who use violence to achieve their goals in what has come to be known as a “Kalashnikov culture”. With such international acceptance and admiration, it was inevitable that the roughly finished, stamped metal and spot-welded weapon would also gain eventual recognition among those who are more style-conscious. In 2004, *Playboy Magazine* listed the AK-47 as one of the “50 Products that Changed the World” after only the Apple Macintosh, the birth control pill and the Sony Betamax video recorder (Kahaner, 2006, p. 3). With seemingly equal ease, it conquered the more reserved British establishment in 2005, when the BBC World Service broadcast a week-long series of documentaries devoted to the weapon (“AK-47: Iconic Weapon”, 2005). In the world of music, and unlike the other firearms used by street-gangs, such as the MAC-10, and their associated musical subcultures, the AK-47 has been a cause of more serious artistic inspiration. Perhaps the best known of which is Goran Bregovic’s “Kalshnikov”, a song that was internationally popular in the 1990s and which was also performed at the opening ceremony of the 2008 Eurovision Song contest held in Belgrade, Serbia (TV-Novosti, 2009. para. 2). In the visual arts, the Kalashnikov is also well-represented, particularly in those countries that it has most strongly affected. For example, it is a key motif in the artwork of “War Rugs” from Afghanistan. There have been touring exhibitions in museums and galleries of these traditionally hand-woven rugs that have depicted conflict in Afghanistan in their patterns since the 1979 Soviet invasion, and which often combine ancient tribal designs with tanks, fighter-jets, grenades and the wide use of the inevitable and unmistakable profile of the AK-47 (Kirsh, 2011, para. 1, 2, 4). Such serious levels of attention from the arts media, as opposed to sensational news reports, has resulted in the real gun and its imaginary version no

longer requiring each other to increase their individual levels of recognition and association. In fact, the image of the AK-47 has become so well-known, and has such strong associations that it has been used to market a huge mass of seemingly unrelated products. Even in countries such as the UK, which have strict gun-control laws, there is a healthy trade in AK-47 T-shirts, hats, badges, skateboards, stereo speakers, bumper stickers and coffee cups with a picture or stylized representation of an AK-47 with humorous or political slogans, most of which are of the “fight authority / us vs. them” type as well as famous lines from films that reference the weapon (Cafepress, n.d., “AK-47 Shirts & T-Shirts”; Zazzle, n.d., “AK-47”). These products seem to be generally aimed at relatively affluent young people in Western countries who use the AK-47 image as a quick and effective cultural shorthand. For those with slightly more disposable income, there is even Kalashnikov brand vodka, which may even be bought in one of only 13,000 special one-litre presentation bottles shaped like an AK-47 and delivered in a special, military-style box (ARMS, 2011, “The AK-47 Vodka Souvenir Bottle”). More reputable designers have also been tempted by the possibilities of using the AK-47. In 2005, Philippe Starck designed and produced a luxury set of lamps based around firearms, including one modelled on the AK-47 (Chivers, 2010, p. 4). Given the prices quoted for much of this merchandising, it is unlikely that it will ever be bought by actual guerrillas in Afghanistan or child soldiers in Africa or Burma, who are often the real users of the weapon. Whether it is used to represent political views, sense of humour, or taste in films, vodka and interior decoration, no other object can be said to have achieved quite such a wide variety of applications.

In conclusion, and in much the same way that Coca-Cola is used to describe any kind of cola drink, Hoover can be any brand of vacuum-cleaner and Xerox any type of photocopier, the AK-47 dominates the world of small-arms even though the weapons themselves may be copies from one of the countless factories around the world. From its origins in World War II, to its battles with other arms in the Vietnam jungle and the Iraqi desert, Mikhail Kalashnikov's weapon design has become a more powerful symbol than any other of global conflict, chaos and rebellion. It is rare that any photograph or video of a war-zone is without an AK somewhere in the frame. It has been photographed more often than any super-model, but has a glamour that will not die or fade with age. Its rugged design, reliability and heavy ammunition give its users confidence, and it has proved to be so simple in operation that even children can use it. The reality and reputation of the *Avtomat Kalashnikova* will undoubtedly outlive all those who have ever used one, its iconic status is only made more powerful by the death, destruction and carnage that follow in its tracks. It is currently resident on every continent and has moved beyond mere human considerations of war, politics, crime, status or money. The AK-47 is truly in a class of its own.

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Acoustic Challenges in Domed Buildings:  
The Evolution of Mimar Sinan's Selimiye Mosque

**format ???**

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## Acoustic Challenges in Domed Buildings: The Evolution of Mimar Sinan's Selimiye Mosque

Thesis: The design of a dome presents inherent acoustical challenges for which, based on historical solutions, Mimar Sinan created civilization's first acoustical space in his Selimiye Mosque.

### I. Role of dome in mosque and its acoustic challenges

#### A. Symbolic and acoustical role of dome in mosque

1. Architectural significance
  - a. Byzantine influence and symbolism
  - b. Vast inner spaces
2. Acoustical perception
  - a. Visual and aural awareness
  - b. Devotional atmosphere

#### B. Unique challenge of the dome

1. Basic acoustic working of a dome
2. Realizing a homogenous dissipation of sound energy in a room (diffuse field)
3. Realizing the decay of sound energy at the optimum level (reverberation time)

### II. Vitruvius' writing on acoustics and its development through Anatolian civilizations

#### A. Vitruvius

1. De Architectura reveals ancient acoustic knowledge
2. Copper vases and other acoustic devices

#### B. Development of acoustic knowledge in Anatolia



1. Ancient Greece
2. Seljuk and Ottoman knowledge

### III. Development of Sinan's acoustic solutions

#### A. Cavity resonators placed in the dome

1. Creation of a diffused field
2. “Divine” quality of sound

#### B. Subsequent development of positioning of muezzin's mahfil

1. Şehzade Mehmet Mosque
2. Süleymaniye Mosque
3. Selimiye Mosque

#### C. First real acoustical space at Selimiye

1. Recent renovations reveal reasons for design decisions
2. Debate about Selimiye layout

Acoustics is the science of sound. The basic aim of this science has through the ages been to improve the conditions for better hearing. Anatolia has been the cradle of various civilizations and their monuments and technologies have in many cases withstood the ravages of time. There is evidence of attempts at acoustical solutions since early times. The development of centuries' experiments with acoustical science culminated in the architecture of the Ottoman time, which is synonymous with the buildings built by the architect known as Koca Mimar Sinan (1489 -1588), a renaissance man who built prolifically all over Turkey and is best known for his design and engineering genius in his great mosques. Above all, the acoustic systems he applied are among the most successful applications of acoustic science in history. The design of a dome presents inherent acoustical challenges for which, based on historical solutions, Mimar Sinan created civilization's first acoustical space in his Selimiye Mosque.

The dome plays an important symbolic role in the mosque but it also presents unique challenges. The Ottomans introduced central dome mosques in the fifteenth century with large domes centred over the prayer halls. As Saoud (2004) explains, this style was heavily influenced by the Byzantine religious architecture with its use of large central domes where the symbolic significance of the dome or half a sphere on a square base denotes the combination of symbolic and mystical essence to represent a space that is sacred (p. 11). Furthermore, the Ottomans mastered the technique of building vast inner spaces, as illustrated by Figure 1 where the seemingly weightless yet massive domes achieve perfect harmony between inner and outer spaces, as well as in the contrast between light and shadow. Moreover, in some spaces such as concert halls or religious buildings, acoustical perception is sometimes even more important than visual perception. For instance, a mosque is one of those

rare buildings where these two aspects are of almost equal importance for human perception (Karabiber, 1999, p. 1044). Thus, not only is the observer visually awed by the space but also becomes aurally aware. Moreover, as stated by Burelli (1988), the fundamental aim of a religious building is to make the worshipper feel closer to God and to evoke a devotional atmosphere (pp. 15, 16). Therefore, it is reasonable to conclude that in this pursuit, acoustical perception, as well as symbolism plays an essential role in creating a place of divine worship.

Aside from the symbolic significance, the dome is one of the most challenging shapes in architecture. Primarily, its concave shape is the main reason why it is difficult to use it to create an optimum acoustic space. As can be seen in Figure 2 in such a structure sound energy reflects several times and especially in large domes the sound energy is increasingly delayed. The effect is that the reflected sound energy causes a time delay and intelligibility is thus reduced by subsequent echoes (Dare, 2006, p. 3). The first prerequisite to create the best hearing conditions is the homogeneous distribution of sound energy. The components in and on the boundaries of a space are used for this purpose and the sound is distributed in all directions (Kayili, 2005, p. 4). A diffuse field is thus created. Secondly, sound energy is emitted from its source in spherical waves and if they do not strike and are not reflected by any surface or component, they will continue to travel until all the sound energy is absorbed by air. In enclosed spaces, the sound energy reflected from the boundaries continues to exist while slowly decreasing (Kayili, 2005, p. 3). Thus, the time of reverberation is lengthened or shortened in relation to the sound absorption characteristics of components found in the space and the surfaces at the boundary of the space (Fausti, Pompoli & Prodi, 2003, p. 2). Finally, the decay time of sound energy is called reverberation time. A short reverberation time leads the ear to feel unsatisfied, and a long reverberation causes components to mask the following

ones, which results in insufficient intelligibility (Kayili, 2005, p. 4). Therefore, realizing an optimum reverberation time allows the best hearing conditions and the sound absorption characteristics of finishing materials of boundaries and other components in the space also contribute to the optimum result. Vitruvius' famous treatise is considered as the first documentation on acoustics and its science was also developed through different civilizations in Anatolia. To begin with, the first century Roman architect Marcus Vitruvius Pollio, in his book titled *De Architectura Libri Decem (Ten Books on Architecture)* carefully described existing practices of architecture. Although some references were in existence on sound and hearing, Vitruvius is accepted as the first author to document acoustical systems for better sound quality (Kayili, 2000, p. 1). What is more, in his fifth book Vitruvius gives precise design rules for amphitheatres and emphasizes acoustics in amphitheatres. In fact, Godman (2008) writes that Vitruvius' knowledge of acoustics was very impressive. He was aware of an acoustical problem caused by the reflection of sound waves; namely that the influence on the original source is created by reflections making the original less clearly audible (p. 3). Taking into account that the science of sound was only formulated much later, this is remarkable. In his *Ten Books on Architecture* (trans. 1960), Vitruvius states, "In theatres, also, are copper vases and these are placed in chambers under the rows of seats in accordance with mathematical reckoning. ...The differences of the sounds which arise are combined into musical symphonies or concords: the circle of seats being divided into fourths, fifths and the octave." This would indicate that Vitruvius suggested that sounding vessels (cavity resonators) made of bronze must be placed in the theatre structures to reinforce the quality and harmonic structure of sound and he explains their resonances, installation location and form in detail in these early writings.

In addition to the inclusion of information in Vitruvius' *Ten Books on Architecture* on the acoustic design of amphitheatres, the oldest known acoustical systems, namely cavity resonators were used in the ancient world, and were also continually applied in Anatolia. The reason was that in ancient Greece the Western type of theatre demanded an acoustical setting. Godman (2008) explains that by making the auditorium at Ephesus a slightly greater than 180 degrees, the ends of the cavea (the semi-circular, tiered seating area of an ancient theatre) would embrace the stage building like the ends of a fan and thus enable the sound produced on the stage to be projected to the auditorium without being dispersed. Moreover, niches were made in the wall behind the central walkway, into which, in accordance with canon rules of music, bronze vessels open on one side were placed, each of which produced a different timbre of sound (p. 2). Therefore these vessels, known as Echeia in ancient Greece, may be the oldest cavity resonators used in architectural acoustics, and may also be the origin of cavity resonators used in Anatolia. However, these developments did not end with the ancient Greeks or the Roman Empire; on the contrary, their existence continued and developed in Anatolia. Examples are frequently seen in both Seljuk and Ottoman works. Kayili (2005) gives the Gevher Nesibe Sultan Darusshifa (A. C. 1205) in Kayseri from the Seljuk period as one of the best examples. In this hospital, the music played for therapeutic purposes was heard in the patients' rooms by means of sound channels and states that the widespread use of cavity resonators is also seen early in Ottoman architecture (p. 2). Research thus shows the continuing development of the applications of acoustic knowledge in Anatolia. The development of applications and technology covering acoustic knowledge reached its peak with Sinan with the placement of cavity resonators and the positioning of the muezzin's mahfil (screened and elevated loge), culminating in the creation of the first acoustic space:

Mimar Sinan's Selimiye Mosque (1575) in Edirne. To start with, Sinan, in his mosques, was faced with the problem of distributing sound homogeneously in a huge space so that the worshipper during the prayers can hear and follow the imam who stood at the mihrab corner. Further to this challenge, the concave form of the dome is inconvenient in acoustics so the purpose of the cavity resonators becomes apparent. For instance, according to Saoud (see also Kayili, 2005, p. 8) cavity resonators (Figure 3), placed in the dome itself, prevent the reflection of sound energy and re-radiate it throughout the room. Resistance in the neck of the resonator and oscillation in the cavity reradiates the sound energy in a homogeneous distribution (2004, p. 12). Thus, by re-radiating the incident energy in all directions, the room becomes a diffused sound field and the danger of echoes due to delayed reflections from the dome is eliminated. Besides getting a diffused field, the sound coming from the dome shortly after the direct sound can give a so-called "divine" quality to sounds carried through the mosque and as a result this application became a tradition in Ottoman mosques (Kayili, 2005, p. 8, see also Topaktaş, 2003, pp. 15-20). In view of this information, the acoustic properties of Sinan's mosques prove the advanced level of his knowledge as regards to acoustics and his ability in utilising them in architectural design.

Besides the positioning of cavity resonators in the dome, the muezzin's mahfil is placed in different positions in the Şehzade Mehmet, Süleymaniye and Selimiye mosques. Through the different positioning of the mahfil, it is clear that Sinan searched for a solution to attain sufficient intelligibility. As the studies of Kayili (2005, p. 12) and Karabiber (1999, p. 1045) document, the calculations of the interior volume of all three mosques illustrates that there is a lack of sound power due to the positioning of sound sources in the mosques (2005, p. 12 ). For instance, the Şehzade Mehmet Mosque (1548) has an interior volume of almost

50,000 m<sup>3</sup> and the muezzin's mahfil is located next to the northwest pillar. Table 1 indicates that only a massive choir can produce the sufficient sound power for the room size of that interior volume. Therefore, it is evident that although there are cavity resonators in the dome, the sound energy will remain insufficient. Furthermore, in the even larger interior volume of the Süleymaniye Mosque (1558), Sinan tried to increase sound power by a number of sources. For this purpose, he placed the muezzin's mahfil near the mihrab, and in addition, he added two small mahfils to the two north pillars. This explains that Mimar Sinan was aware of the acoustical challenge but these placements may lead to reflections and division of space to “sound rooms” (Özgüleş, 2003/2008?, p. 24). Moreover, in the positioning of the muezzin's mahfil for the Selimiye Mosque in Edirne, Mimar Sinan succeeded in finding a solution to the acoustic problem by designing a total space for the interior of the mosque, not divided into acoustic spaces reduced to the size of room. The interior volume of the Selimiye Mosque is approximately 75,000 m<sup>3</sup> and, naturally, there is the problem of sufficient power of the sound source. According to Kayili to overcome this problem, Sinan placed the muezzin's mahfil exactly in the centre of the total space with the dome and cavity resonators directly above the sound source (2005, p. 14). As a result, the resonator system that diffuses the sound energy into the room is close by and receives no reflected sound; it takes the sound energy directly from the source and diffuses it throughout the entire room space. The impact of this system is that a single human voice is reflected most beautifully, and if even the sound is amplified it does not resound nor does it fade even in the Selimiye Mosque's huge space.

As a result of Sinan's knowledge and his experimentation with the positioning of cavity resonators in the dome and the positioning of the muezzin's mahfil (Figure 4) at the Selimiye Mosque, an acoustic space was created. An acoustic space is defined as a space

where the sound energy radiates from above and defines a space. Indeed for the first time in civilization an acoustic space was created (Burelli, 1988, pp. 73-82.; also see Kayili, 2005, p. 14). Moreover, in Mimar Sinan's architecture no design decision is taken without reason. Fausti et al. (2003) indicate that recent renovations have brought to light that the acoustical design was not limited to the above measure but also to the choice of plasters and other finishing materials (p. 1). In addition, as Kayili asks "For many years, historians have sought the answer to the question 'after creating a total space [of such a dimension], why did he put the muezzin's mahfil right in the centre?'" (2005, p. 14). The answer is obvious; it was the answer to Mimar Sinan's lifelong search and eventual realization of an acoustical space.

In conclusion, Mimar Sinan created the first acoustical space in his Selimiye Mosque by the use of cavity resonators and many other planning solutions, and research has shown that the technology of cavity resonators is an inheritance from ancient civilisations. The dome provides a particular acoustic challenge and Mimar Sinan's solutions in the Selimiye Mosque creates a solution particularly suited to the quality of sound required for such as huge space and with the timbre of sound needed for a place of worship. Research projects regarding Mimar Sinan's design require the participation of engineers, physicists and other technical specialists. It should also not be forgotten that with every restoration effort, technology that was not completely understood was completely lost or still remains under plaster (Figure 5). Therefore, all new restoration must be carried out by teams composed of experts from many fields of science.



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Table 1.

*Maximum Room Volume According to Type of Sound Source*

Type of sound source	Maximum room volume (m <sup>3</sup> )
Average speaker	3000
Experienced speaker	6000
Instrumental or vocal soloist	10000
Large symphony or orchestra	20000
Massed Choirs	50 000

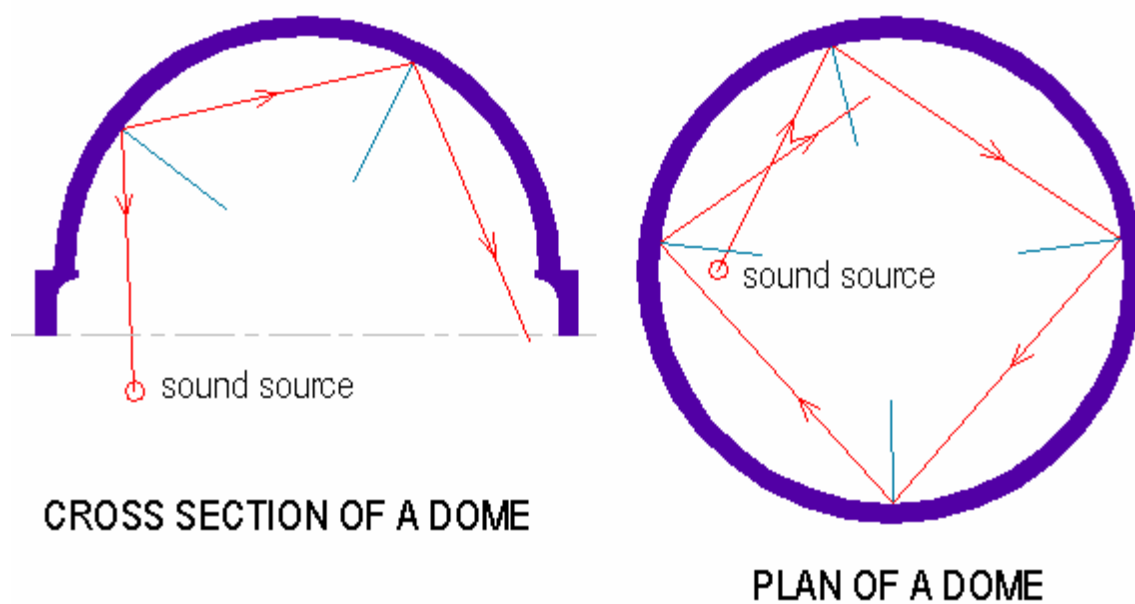
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From *Acoustic solutions in classical Ottoman architecture*. By Kayili, M., 2005. Retrieved from Foundation for Science Technology and Civilization database (p. 12).



*Figure 1.* The Suleymaniye Mosque with seemingly weightless yet massive domes.

Copyright: Esbie van Heerden



*Figure 2.* Behaviour of sound energy in a dome.

From "Acoustic solutions in classical Ottoman architecture" by Kayili, 2005. Copyright Foundation for Science Technology and Civilization.

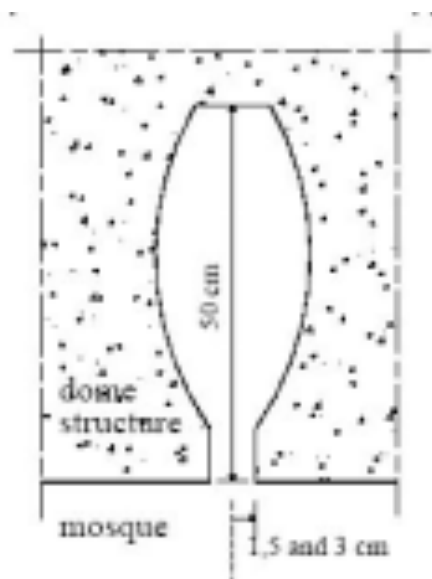
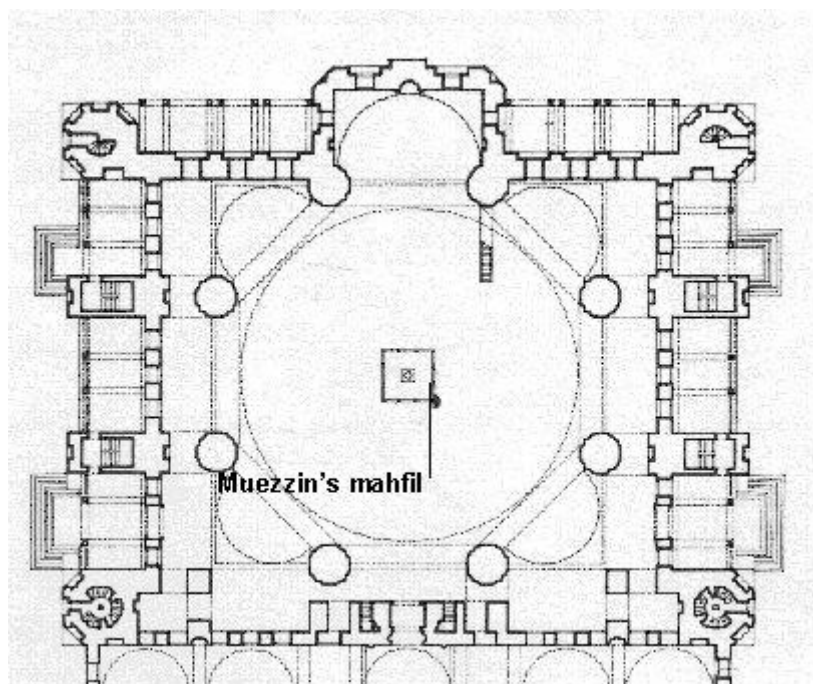


Figure 9. Cross section of the resonators found in the dome of the Sultan Ahmet Mosque

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*Figure 3.* An Ottoman era cavity resonator.

From “Acoustic solutions in classical Ottoman architecture” by Kayili, 2005. Copyright Foundation for Science Technology and Civilization.



*Figure 4.* The plan of the Selimiye Mosque with a centralised mahfil.

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*Figure 5.* A plugged upper resonator in an Ottoman mosque.

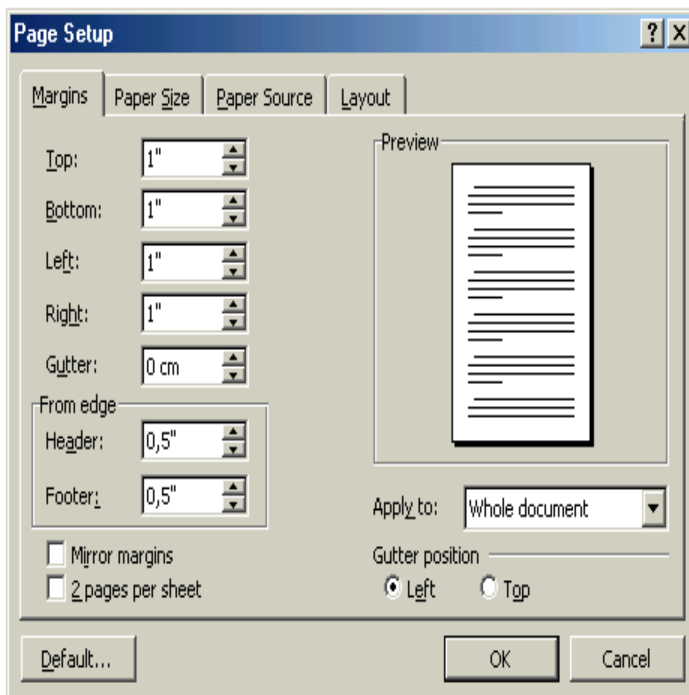
From “Acoustic solutions in classical Ottoman architecture” by Kayili, 2005. Copyright Foundation for Science Technology and Civilization.



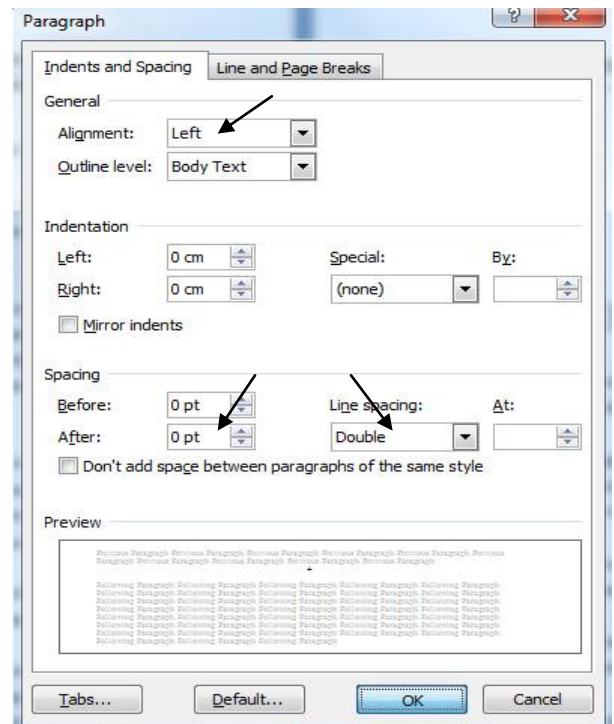
## APPENDIX: Tips for formatting

### Applying format rules on a word document

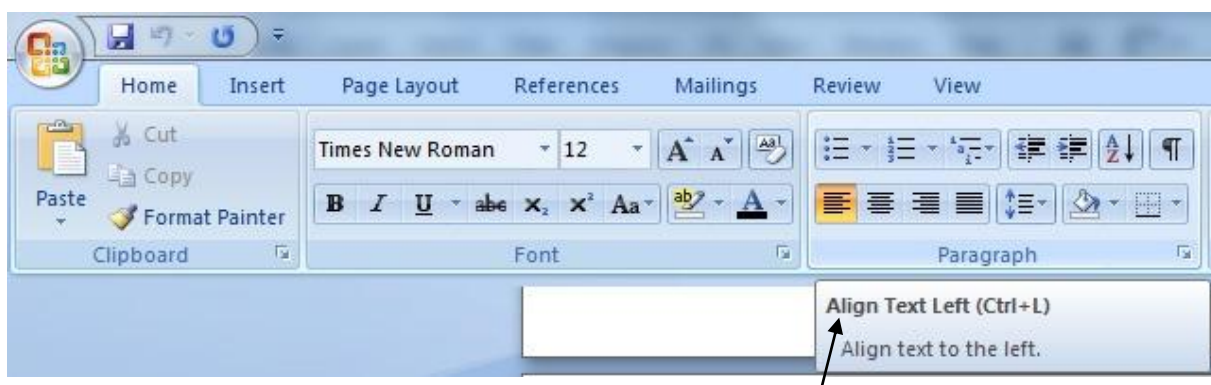
#### Arranging the margins



#### Fixing double space between lines

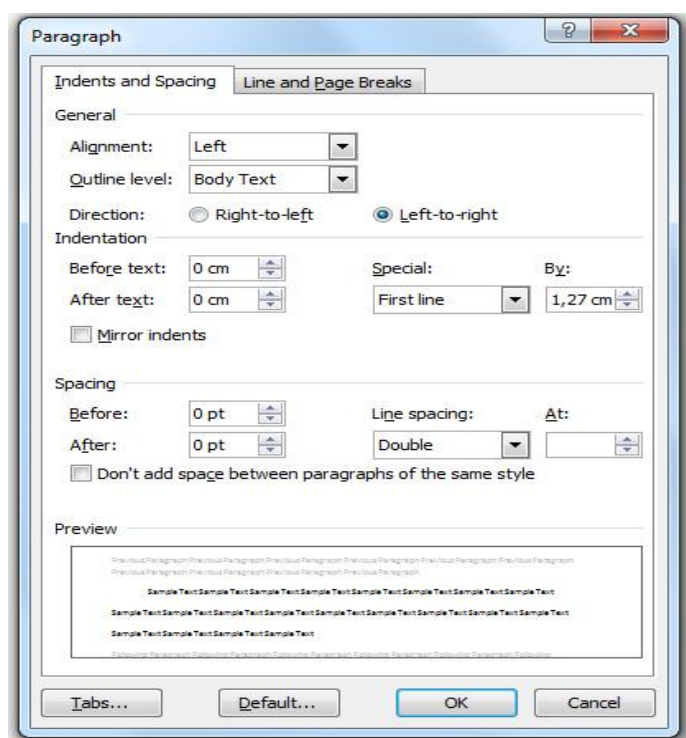


#### Choosing the font and alignment



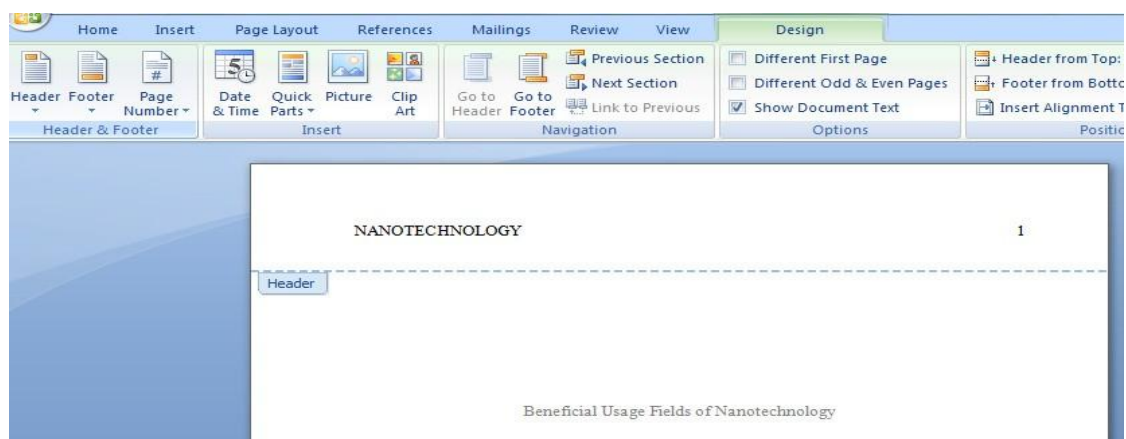
## Formatting paragraphs

See the print screen below to be able to format your paragraphs correctly.



## Putting page numbers

Use 'Header & Footer' to insert page numbers and the shortened form of the title:

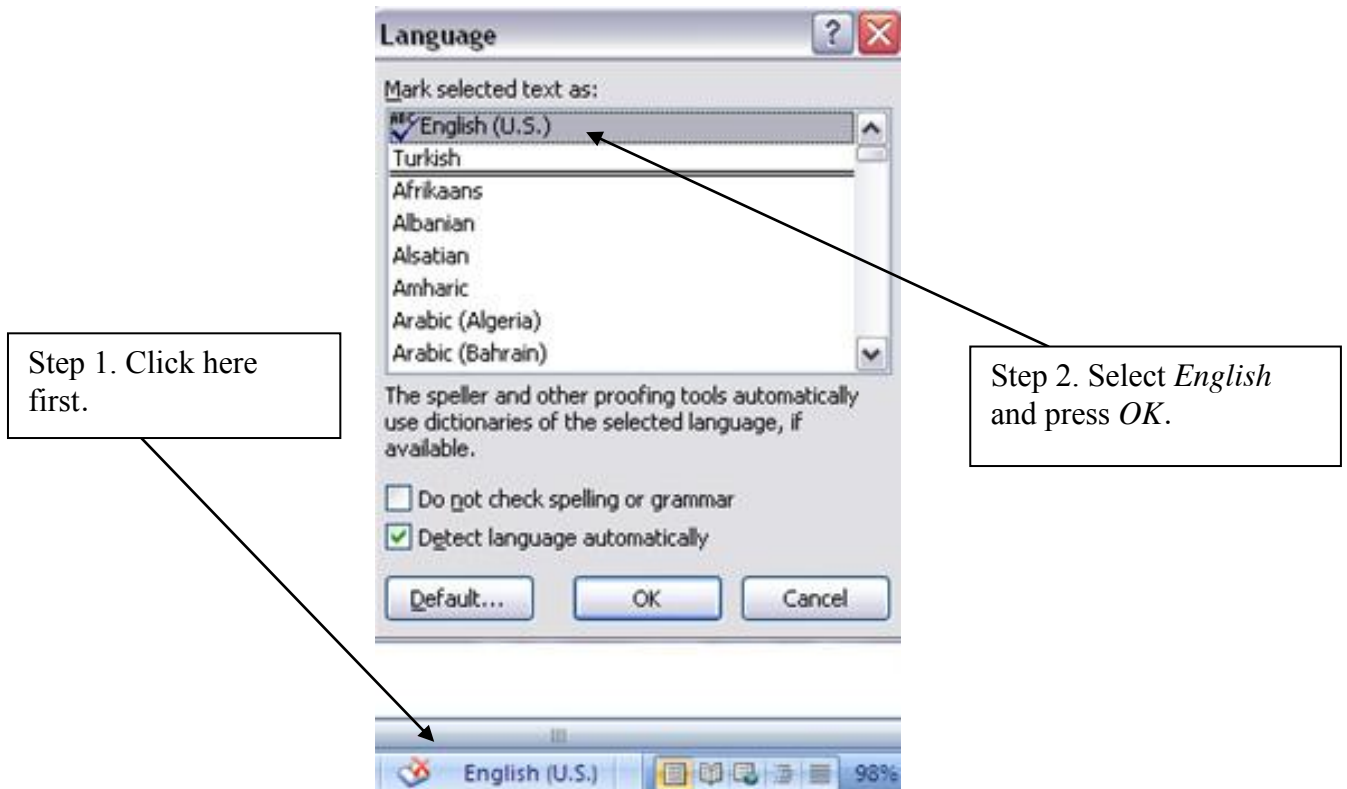


## Selecting the language

When English is chosen as the default language, spelling mistakes will be underlined.

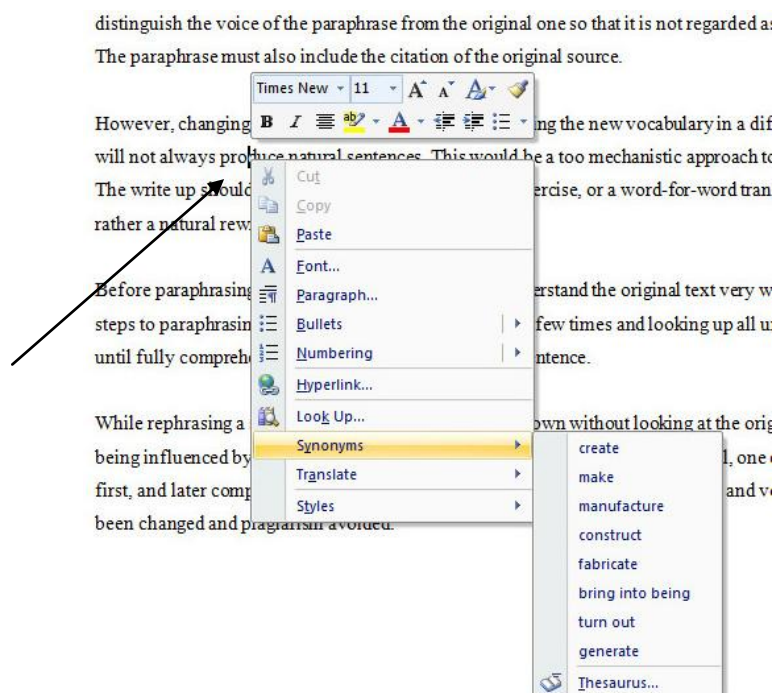
Right-clicking the underlined word, the writer can choose one of the options for the correct word.

For spelling check, select the whole document, then select language as described below.



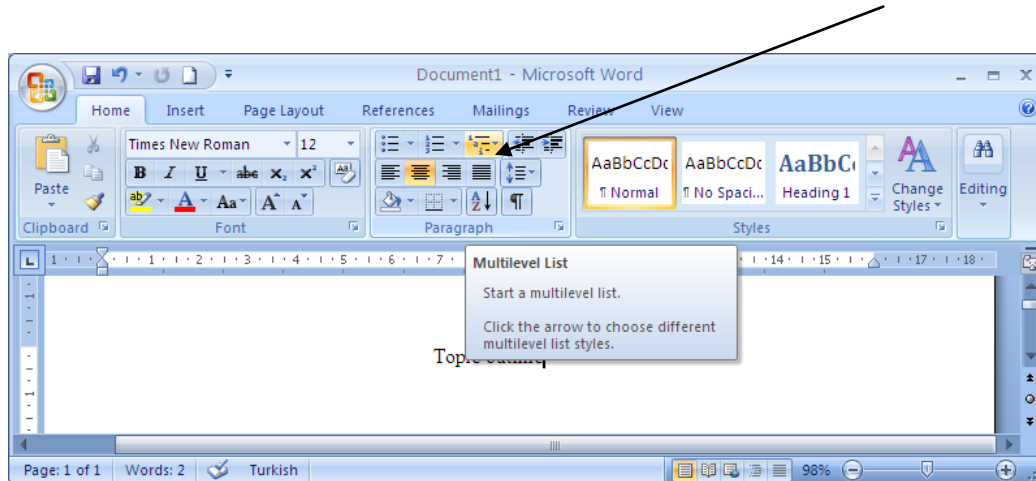
## Finding synonyms

If the language is set as English, the word program can also be used for finding synonyms during the paraphrasing and summarizing stage. Press right click on the word you want to rewrite and a window with suggested synonyms will appear.



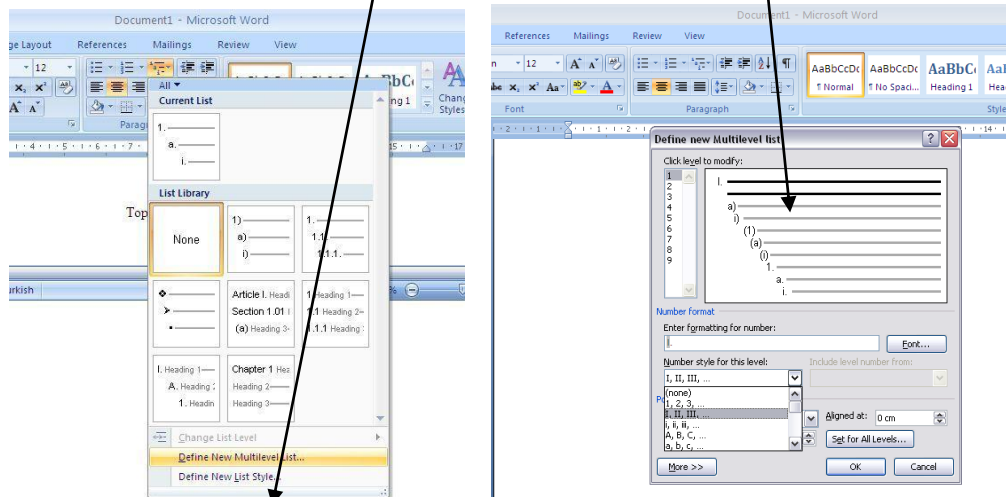
## Preparing the research outline list

To make a neat outline with all the similar divisions aligned with correct spelling and indentation, go to *multilevel list* tab.



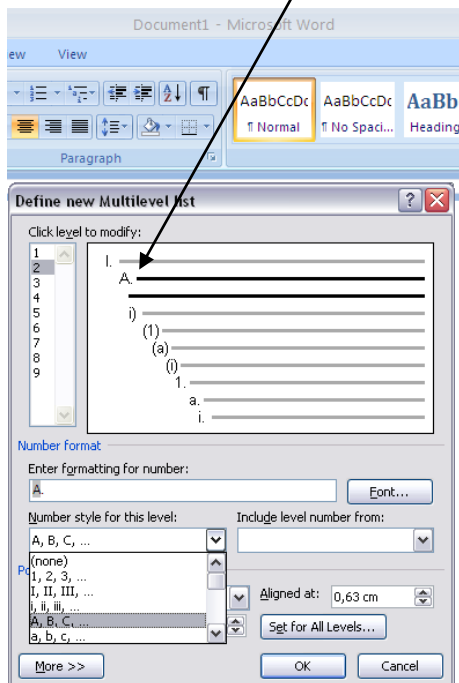
From the window, choose *define new multilevel list*. On the list, apply the following steps:

click level to modify: 1  
number style for this level: I, II, III...  
enter formatting for number: change 1 to I.

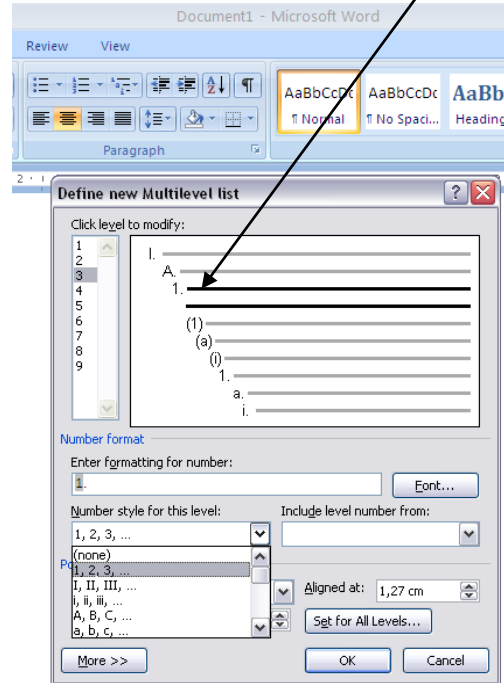


For further divisions, apply the following steps as shown in the pictures:

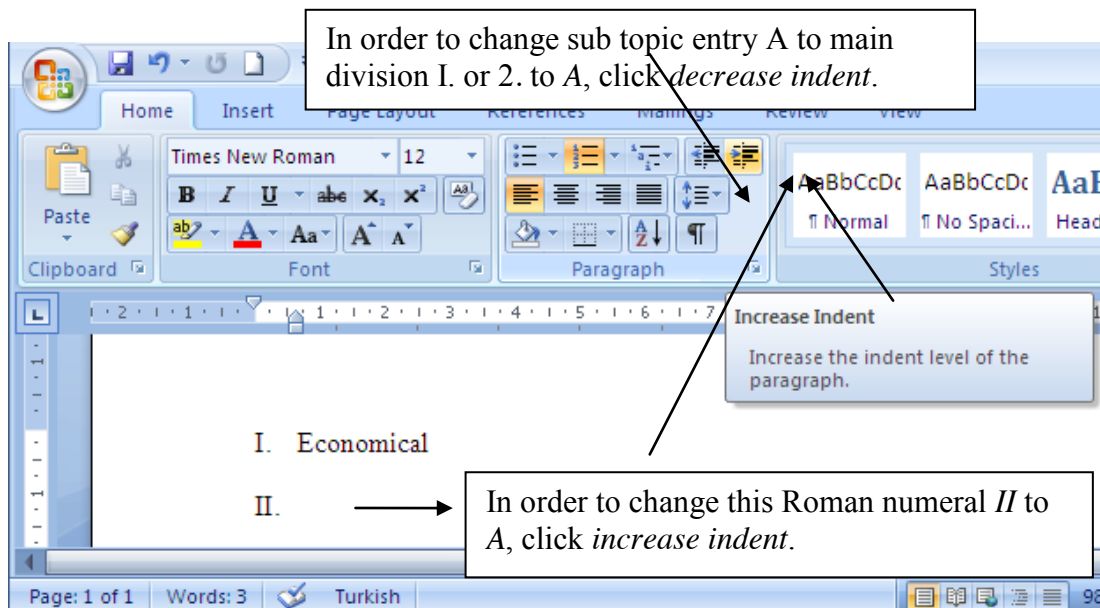
click level to modify: 2  
number style for this level: A, B, C...  
enter formatting for number: A.



click level to modify: 3  
number style for this level: 1, 2, 3...  
enter formatting for number: 1.

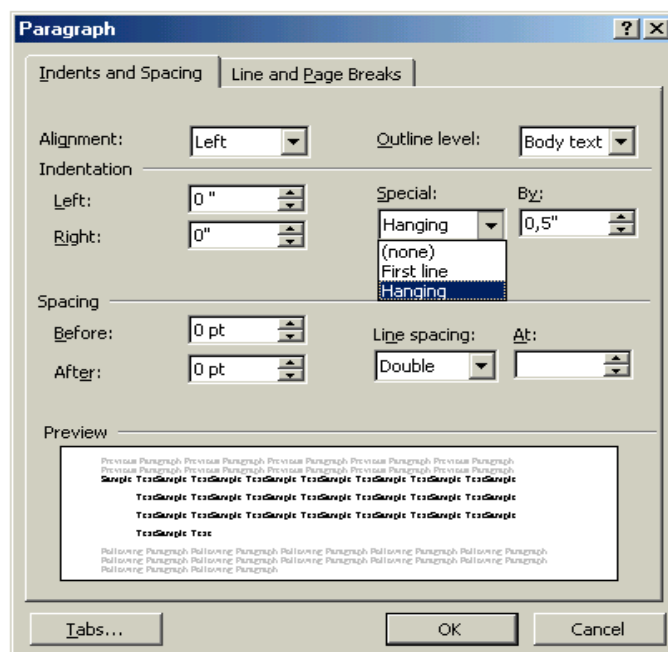


By clicking *increase indent* tab, it is possible to automatically go one step down to the subtitle. That is, if A is preferred instead of II, then click *increase indent*. Word will automatically write A. Likewise, when it is time for changing a sub step to a main step, click *decrease indent*.



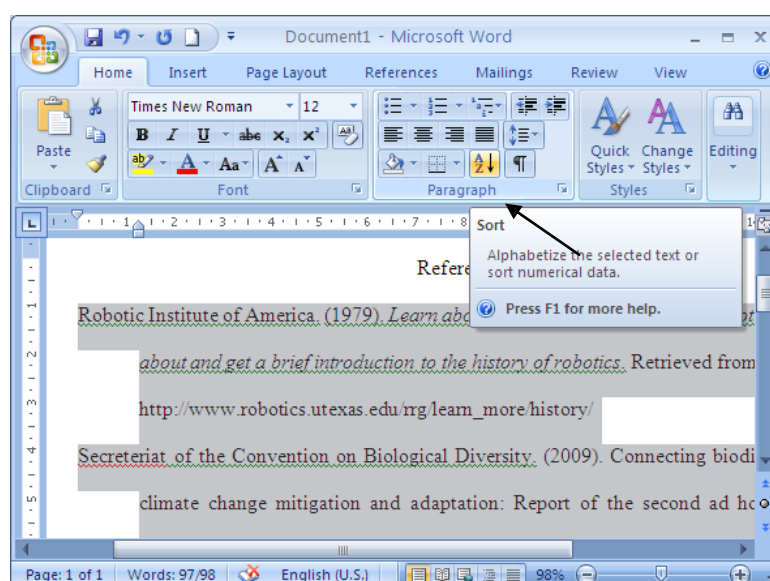
## Formatting references: Hanging indent

Set hanging indentation either at 0.5 inch or 1,27 cm.



## Putting the references in alphabetical order

Click CTRL A in order to select all the reference entries. Then go to *Sort* on the *Paragraph* tab. Click *OK* in the new window. The references will automatically be put in alphabetical order. Remember to re-order the entries starting with articles (a, an, the).



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  - Edited conference paper
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  - New
  - Revised
- Editor(s)
- Educational institutions
- Electronic sources
  - Electronic encyclopedia article

Electronic journal article	Statistics, examples, memorable events
Electronic magazine article	Thesis
Electronic newspaper article	Issue number
Ellipsis	Journals
Ellipsis with 3 dots	Journal article
Ellipsis with 4 dots	Journal article with indirect information
Encyclopedia	Keywords
Encyclopedia article	Lowercase letters (a b c)
Encyclopedia title	Magazine article
et al.	Magazines
Ethics	Main division
Ethical rule	Main idea(s)
Ethics in research	Major division(s)
Accuracy	Major section(s)
Acknowledgement	Master's theses
Honesty	printed
Nondiscrimination	from the web
Objectivity	Methods
Protection of intellectual property	Qualitative (non-numerical) methods
Protection of people and animals	Quantitative (numerical) methods
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Figure caption example	n.d.
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Format <i>See also</i> Typing rules	No individual writer
Format rules of the outline	No organization
Formatting paragraphs	No page
Government	No writer
Handbook	Non-English sources
Hanging indentation	Non-English article in a magazine
Headings	Non-English article in a newspaper
Subheadings	Non-English stand-alone article
Hyperlink	Non-English words
Indirect information	Note cards
Individual writer <i>See</i> Writer	Note taking
Initials	Numbers
Interpreting and commenting on source information	Online articles
In-text citations	Online sources
Introductory paragraph/introduction	Abstracts
Background information	Conference papers
Definition	Course handouts
Previous work on the topic	Doctoral dissertations
Statements indicating the importance of the topic	E-books
	Electronic encyclopedias



Electronic journals	Print sources
Electronic magazines	Books
Electronic newspapers	Edited books
Electronic versions of print sources	Handbooks
Government publications	Translated books
Master's theses	Brochures
Online dictionaries	Catalogues
Patents	Conference papers
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Organization	Encyclopedias
Organization of paragraphs	Government publications
Originality	Journals (periodicals)
Outline	Magazines
Outline body	Master's theses
Outline division	Newspapers
Outlining	Reports
Page	Processes
Continuous pages	Drafting process
Discontinuous pages	Finalizing process
Multiple pages <i>See</i> Multiple	Research and planning process
Page number	Publication
Pages of the article	Publication date
Paragraph	Publication information
Paragraph number	Publication place
Paraphrasing	Published sources
Patents	Publisher/Publishing company
Patent number	Punctuation
Period	Period
Periodicals	Single quotation marks
Personal comments	Slash (/)
Transition signals and opening	Quoting
phrases for personal comments	Direct quotation
Different ways of making	Quotation
comments	Quotation marks
Advice	References
Deduction	Reference entry
Emphasis	Reference information
Prediction	Reliability
Suggestion	Reporting verbs
Warning	Neutral reporting verbs
Personal communication	Reporting verbs followed by a
Persuasive research writing	“that” clause
Persuasive thesis statement	Reporting verbs followed by a
Pictures	preposition
Place of publication	Reporting verbs presenting a
Plagiarism	certain viewpoint
Presenter	Reporting verbs with a stronger
Primary research	meaning

Rules on using reporting verbs	Supporting details
Selection of a reporting verb (selecting reporting verbs)	Supporting points
Use of “that” with reporting verbs	Surname of the writer
Use of comma with reporting verbs	Symbols
Use of reporting verb with indirect information	Ampersand (&)
Using reporting verbs	Tables and Figures
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Report by a corporate writer	Graphs
Reports published as an edited book	Incorporating tables and figures into the paper
Reports retrieved from the web	Pictures
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Sample concluding paragraph	Capitalized
Sample figure	English translation of article title
Sample introductory paragraph	In italics
Sample note card	Non-English title
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Sample summary	Deciding on a topic
Sample table	Finding a topic
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Secondary research	Transition signals
Secondary source	Transitional paragraph
Section title	Translated book
Single quotation marks <i>See</i> Punctuation	Translator(s)
Slash (/) <i>See</i> Punctuation	Typewriter spaces
Slides	Typing rules
Spacing	Alignment
Square brackets [ ]	Double spacing
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