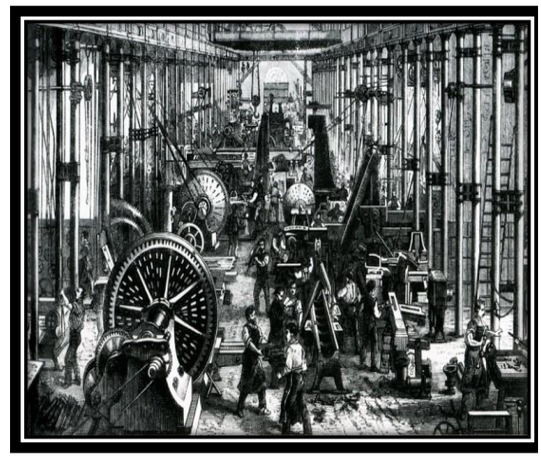
INDUSTRIAL REVOLUTION IN THE 17TH CENTURY
(*Intellectual Revolutions that Defined Society*)

Chapter Outline:

1. The Age of Enlightenment
2. Copernican Revolution
3. Darwinian Revolution
4. Freudian Revolution
5. Information Age
6. Mesoamerican Period (1200 B.C. -3rd Century A.D.)
7. Middle East (17th Century)
8. African Revolution



Source: Hinweise zur lizenzgerechten Weiterverwendung des Bildes/Wikimedia

"The most obvious characteristic of science is its application: the fact that, as a consequence of science, one has a power to do things. And the effect this power has had need hardly be mentioned. The whole industrial revolution would almost have been impossible without the development of science." *-Richard P. Feynman*

At the end of this chapter, the students should be able to:

1. define paradigm shift;
2. articulate ways by which society is transformed by science and technology;
3. trace the history of science and technology in different eras and civilization; and
4. enumerate scientific and technological advancement made by people and some civilization of the 17th century.

INTRODUCTION

The world is in constant flux. Everything, including all the material things and ideas, may change accordingly based on the facts which are an output of human curiosity. Seeking answers to human questions added scientific facts, evidence, and concepts in the network of knowledge understandable by the man. It means that the more questions asked, the more knowledgeable humans become.

In order for us to enumerate and understand the major shifts in the history of science and technology, we must be familiar with the most important scientific events that changed and shaped our society during the time of Nicolaus Copernicus, Charles Darwin, and Sigmund Freud. In addition, we have to study the intellectual changes in Mesoamerica, Middle East, and Africa.

THE AGE OF ENLIGHTENMENT (18TH CENTURY)

The Age of Enlightenment is a period in Europe in the 18th century when many writers and thinkers began to question established beliefs. These beliefs include the authority of kings or the of the Church, in favor of reason and scientific proof. The idea developed that everyone was of equal value and had equal rights.

Copernican Revolution

This caused the paradigm shift of how the earth and sun were placed in the heavens/universe. It is the idea that rejected Ptolemaic model (earth is the center of the solar system) and proved the heliocentric model (Sun is the center of the solar system having the earth revolving around it.)

The theories and ideas from ancient thinkers about the natural world and the universe laid a foundation of how we understand astronomy today. Though there is only a small number of extraordinary thinkers during the time of antiquity, there is always a divergence of theories and ideas of philosophers during that time. The fact that the Earth is not the center of the solar system is only one of the results of scientific revolution. Mathematics was the common tool used by ancient astronomers to explain the motion of celestial bodies and on the latter combined with actual observations that provided enough evidences proving that the Sun is the center of the solar system. The remarkable contributions of ancient astronomers to the development from Geocentric to Heliocentric model of the Universe is listed in table 4.1.

Table 4.1 *Notable contributions of ancient astronomers to the development of the universe*

Aristotle (384-322 B.C., Greek)	Proved that the Earth is spherical Earth was at the center of the universe, i.e., sun, planets, and stars were located in sphere that revolved around the Earth.
Aristarchus (310-230 B.C., Greek)	The first to propose the idea that the Sun was the center of the universe.
Hipparchus (190-120 B.C., Greek)	Considered to be the greatest astronomer of ancient times.
Claudius Ptolemy (85-165 A.D., Greek)	Used Hipparchus observations to develop the Ptolemaic System which describes the Earth as the center of the universe with sun, moon, planets, and stars revolving around it in a circular orbit.
Nicolaus Copernicus (1473-1543,Polish)	Concluded that the Sun, not the Earth is the center of the universe.
Galileo Galilei (1564-1642, Italian)	Supported Copernican model of the universe.
Johannes Kepler (1571-1630, German)	Formulated the three Laws of Planetary Motion.

Darwinian Revolution

This has brought a great impact on how people approach Biology forever. This revolution provided a different than the "theory of Creation". The Darwinian revolution started when Charles Darwin published his book "The Origin of Species" that emphasizes that humans are the result of an evolution.

Charles Robert Darwin (1809-1882) is a biologist who was famously known for his works on evolution and the process of natural selection. He studied Divinity in Cambridge where he met Adam Sedgwick (1785-1873) and the naturalist John Henslow (1796-1861) who brought back his interest in biology and geology.

With the teaching of the church and the influence of Henslow, Darwin also rejected the idea of Lamarck that acquired characteristics are inheritable. His faith altered after five years mapping expedition with the British Army in 1831 headed by Vice-Admiral Robert Fitzroy (1805-1865) of the ship named H.M.S Beagle. He made observations on diversity of organisms in the Galapagos Islands and adaptation which laid the foundation to develop his theory of evolution and natural selection.

Evolution, as explained by Darwin, occurs by means of natural selection, in addition, natural selection might occur because of the following reasons:

a) Overproduction and variation-some species produce many offspring but not all of these will survive. It means that not all of the offspring do not have the characteristics to survive in the environment.

b) Competition and Selection- Competition may or may not be direct but the idea is always on the survival of organism. The organisms that survived more likely reproduce which transfer their characteristics to their offspring.
c) Environmental change- the environment will not adjust for the organism but rather it is always the organism that will change to adapt to the environment.

Freudian Revolution

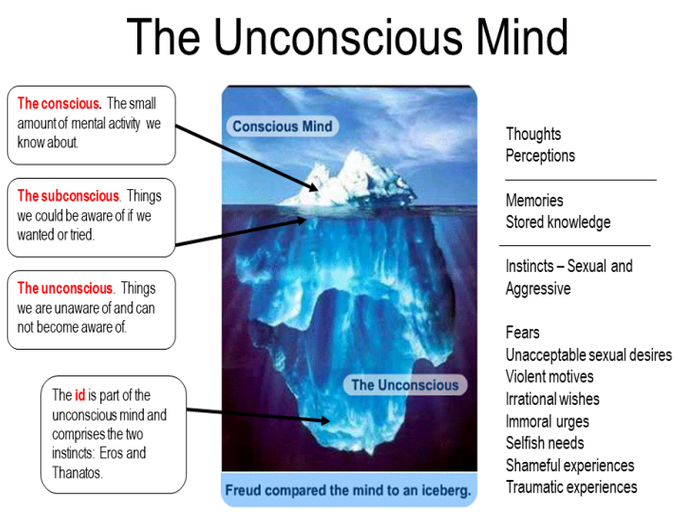
This theory has started to revolutionize Psychiatry with Sigmund Freud. This includes the "Freudian Theory of Personality" that involves the human development contributes to his/her personality and also his "psychoanalysis" that is the process for achieving proper functioning if a human does not complete his/her developmental stage.

Sigmund Freud (1856-1939) explained how human mind works and cure its mild mental illness. He calls this method psychoanalysis and its main goal is to make unconscious conscious. He also developed topographical and structural model of the mind to basically explain the sources of human behavior.

The Topographical Model of the Mind

According to the topographical model of Freud, the mind is divided into three regions. These are the subconscious, preconscious, and conscious mind.

a) Conscious mind- consists of thoughts that focus on the present state of mind.
b) Preconscious mind- consists of what can be retrieved from the memory.
c) Subconscious mind- consists of the primitive desires, wishes, or impulse, which is mediated by the preconscious mind.



Source: https://www.simplypsychology.org/Sigmund-Freud.html

The Structural Model of the Mind

The structural model of Freud elaborates his topographical model which preconscious mind is then divided into superego, ego, id.

a) Ego-drives a socially acceptable way to satisfy the demands of id as it operates the conscious and unconscious mind
b) Id- comprises Eros, the life or survival instinct of man and Thanatos the death or destructive instinct of man.
c) Super ego- operates based on the principles of morality that drive man to become socially responsible and behave in an acceptable manner. It basically means that super-ego drives a man to follow rules and resolves the conflict between ego and the id.

INFORMATION AGE

This has been the era in which technology has been prevalent. It is also known as the Computer Age that has brought so much change on how are we living today.

People view communication as one of the most important tools in understanding society, Communication is defined as the act or process of using words, sounds, signs, or behaviors to express or exchange information or to express ideas, thoughts, feelings, etc., to someone else. It took a lot of time for communication to prosper and develop to what is being used today. Along with the development of technology, the develop to impacts of distance, location, and time were eradicated.

Most of us believe that the beginning of the Information Age is the time when computer was made available to people since computer is the greatest tool used to access the world wide web. Information Age, according to Alberts and Papp (1997) in their paper entitled The Information Age: An Anthology on Its Impact and Consequences, is divided into three modern information revolution: First Modern Information Revolution, Second Modern Information Revolution and Third Modern Information Revolution.

These are the most important events during the modern information revolution:

FIRST MODERN INFORMATION REVOLUTION (MID-19TH CENTURY)

- The invention of telegraph by Samuel Morse (1791–1872).
- Alexander Graham Bell (1847-1922) patented the first telephone.
- Guglielmo Marconi (1874–1937) proved the feasibility of radio communications, i.e. sending and receiving of radio signals.

SECOND MODERN INFORMATION REVOLUTION (MID-20TH CENTURY)

- Lee DeForest (1873-1961) Early generation computers were made available to everyone.
- Philo Taylor Farnsworth (1926-1931) Television as one of the best communication tools.
- Sergci Korolev (1957) Artificial satellites were built and linked the world.
- Claude E. Shannon (1916-2001) quantified information and measured it in bits.

THIRD MODERN INFORMATION REVOLUTION (1980'S)

The third modern information is labeled as "knowledge revolution." This period is only about the development of communication-related technologies that improved society.

Mesoamerican Period (1200 B.C.-3rd Century A.D.)

It has contributed a lot ideas or discoveries for Archaeology. The temple and pyramids left a lot about of Architecture that leads us to study more of it.

The term Mesoamerica comes from the Greek word mesos meaning "in the middle." This period is characterized by the following civilizations:

Olmecs ((1500 B.C.-400 B.C.)

The top of the society are priests and nobles who lived in ceremonial centers.

- Normal people lived in farming villages around the elites.
- Carved colossal heads from volcanic rocks as portraits of rulers.
- Invented calendar and carved hieroglyphic writing into stone.
- The mother culture of Mesoamerica.

Mayans (300 B.C.-900 A.D.)

Developed methods of farming such as shifting agriculture and raised bed farming.

- Organized into city-state without political unity but bounded economy.
- Developed numbering system including place value and the concept of zero.

- Developed hieroglyphic form of writing that were used for recording astronomical observations, rituals and religious matter but was burnt during the invasion of Spanish conquerors.
- Developed a solar calendar with 365 days and ritual calendar with 260 days.

Aztecs (12th-15th Century)

- Built chinampas or “floating gardens” to plant crops.
- Built empire which has a ruler with his council consisting of nobles, priest, and military leaders.
- Developed a calendar with 365 days and a ritual calendar with 260 days.
- Believed that illness is a punishment from the gods but still uses herbs and medicine for treatment

Middle East (17th Century)

The revolutions in the Middle East were a product of the development and growth of individual nationalism, imperialism, for the efforts to western and modernize Middle Eastern societies, and to push the declining power of the Ottoman Empire in the Arab region.

Middle east is a term used to describe a geographic location that extends from Egypt to Afghanistan where Islam arose. Islam, however, is a religion of right actions, rules, and laws that began in the 7th century and follows the teachings of Muhammad who was believed by Muslims as the messenger of God. Islam is also an Arabic word meaning “submission to God”. Islamic rules are symbolized by five obligatory acts or the five pillars of Islam: Witness(Shahada), worship (salat), fasting (Sawm), Tithing (Zakat), and Pilgrimage (Hajj). If the Roman Catholic Church has the “Bible” Islam, on the other hand, also has its holy book called Qur’an (Koran).

Seemingly different to other ancient civilizations like Europe, Isla as religion plays an important role not only in Arab ways of living but also in the advancement of science. The pursuit of knowledge is included in the teachings of Prophet Muhammad. This practicality of Islam and openness to embracing knowledge resulted to some advancement in the field of geography, medicine, and mathematics.

Contributions to Geography

- Salat prayers require knowledge in geography to know the direction of the Qublah, i.e., the direction that should be faced when Muslims pray.
- In 1166, Al Idrisi produced very accurate maps including a world map that has continents, mountains, rivers, and famous cities.
- Al-Muqdishi, a geographer, also produced an accurate colored map.
- Muslims are great navigators for the expeditions of other countries. Ferdinand Magellan and Christopher Columbus imported Muslim navigators.

Contributions to Mathematics

- Muslims invented symbols to express an unknown quantity.
- Made use of zero and decimal system.
- Muhammad ibn Mūsā al-Khwārizmī (early 9th century), one of the first directors of the house of Wisdom, introduced algebra in solving equation.

Medical Contributions

- Arabs made use of human cadaver to study and understand its anatomy and physiology.
- Abū-‘Alī al-Husayn ibn-‘Abdallā Ibn-Sīnā or Avicenna (ca. 970-1037) wrote an encyclopedia of medical knowledge. This work was translated into Latin and was used as a textbook in Europe up to 17th century.
- Abū Bakr Muhammad ibn Zakariyya al-Razi spearheaded the construction of the first Islamic Bimaristans (hospital)

African Revolution

The fight against colonialism and imperialism in Africa.

Africans like other Eastern civilizations are pioneers of some advancement in science and technology. They worked independently without any influence of European science. Some remarkable works of Africans were in the field of mathematics, metallurgy, architecture and engineering, astronomy, medicine, and navigation. The remarkable contributions of Africans are the following:

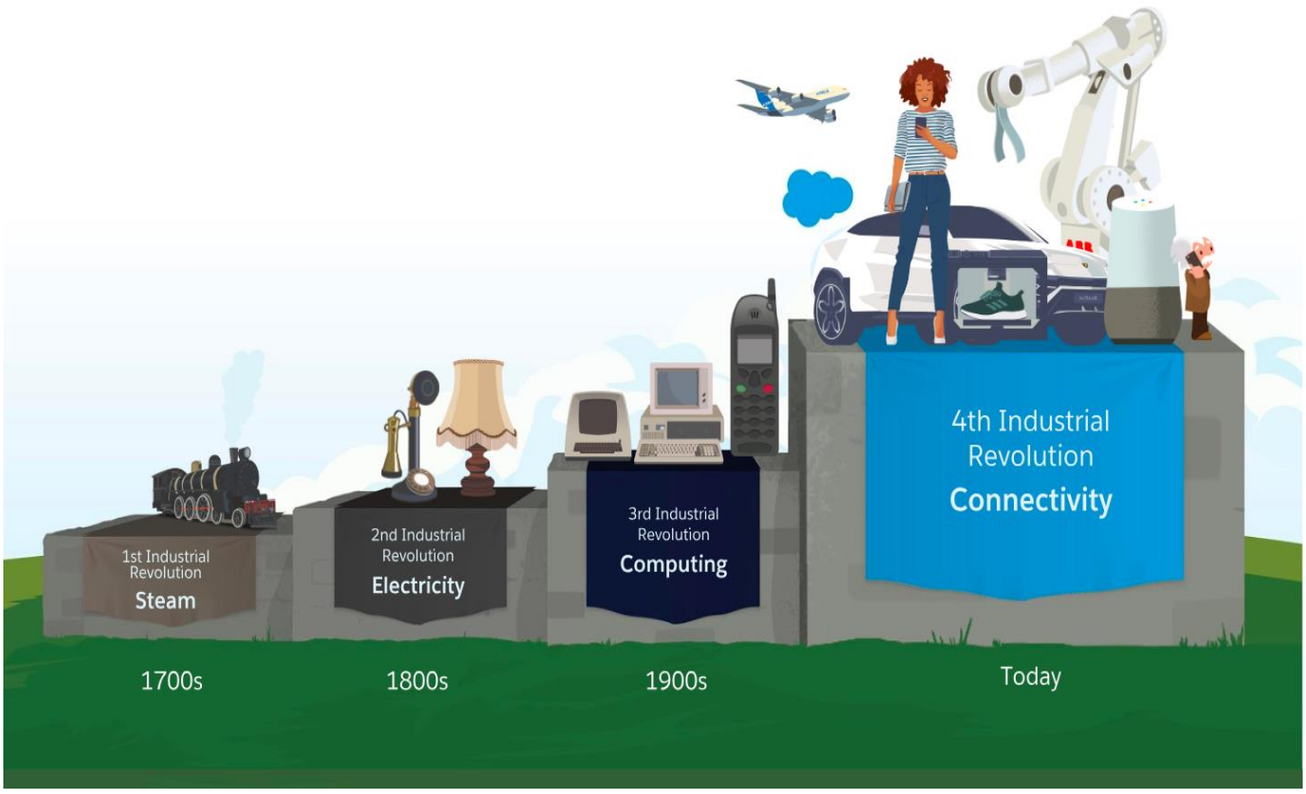
- Africans made use of the first method of counting.
- The modern concepts of mathematics that is globally accepted and used today in high schools was first developed in Africa.
- Used advanced techniques for furnace that made it fuel efficient which was 200 to 400°C hotter compared to 1600°C-furnace used by the Romans.
- Created the building of Zimbabwe and the 11 interconnected rock-hewn churches of Lalibela in Ethiopia which are considered as wonders of the world.
- Observations on Sirius A and B by Dogon people.
- Cushitic people used their knowledge of stars and constellations to calculate and establish an accurate calendar.
- Pioneered some medical practices like installation of false teeth, filling of dental cavities, broken bone setting, bone traction, vaccination, brain surgery, skin grafting, and autopsy.
- Made use of plants like the bark of *Salix capensis* as source of aspirin, kaopectate for treating diarrhea and *Rauwolfia vomitoria* as source of reserpine for hypertension and snakebite.
- Built boats in varying sizes with the largest that can carry a load of 80 tons.

References:

Bautista, D., N, Burce, J. Marasigan-Dungo, C. Garcia, J. Imson, R. Labog, F. Salazar and J. Lee-Santos.2018. Science Technology and Society. Maxcor Publishing House, Inc.

https://www.slideshare.net/rey_john_rey/intellectual-revolutions-that-defined-society?from_action=save

ACTIVITY 4 PICTURE ANALYSIS. (For All Classes). Study and analyze the picture below. Make a 1-page analysis based from your own understanding and include a prediction on what the 5th Industrial Revolution will be in the future. Send your work to your respective GEC 17 Google classrooms (Classes A and B) and in a short bond paper for Class C. Your instructor will set the deadline of submission.



Criteria	7	5	3	1
Objectivity	Makes a complete and detailed description of the subject matter and/or elements seen in the photograph.	Makes a detailed description of most of the subject matter and/or elements seen in the photograph.	Makes a detailed description of some of the subject matter and/or elements seen in the photograph.	Descriptions are not detailed or complete.
Knowledge	Provides a complete summary of the situation and time period shown, and the people and objects that appear.	Provides a somewhat complete summary of the situation and time period shown, and the people and objects that appear.	Provides some summary about the situation and time period shown, and the people and objects that appear.	Summary is not detailed or complete.
Interpretation	Forms a reasonable hypothesis about what is viewed in the photograph and is able to support this with evidence from the photograph.	Forms a somewhat reasonable hypothesis about what is viewed in the photograph and is able to support this with some evidence from the photograph.	Relates how the photograph makes him/her feel personally.	Finds it difficult to interpret the meaning of the photograph.