

## Francis Bacon and the Scientific Revolution

### I- The Scientific Revolution (16<sup>th</sup> and 17<sup>th</sup> centuries)

#### Chronology of events

1543 Copernicus' heliocentric theory of the universe  
1543 Vesalius' work on human anatomy  
1609 Kepler's discovery that Mars moves in an elliptical orbit.  
1610 Galileo publishes *The Starry Messenger* reporting his discoveries that challenge the old view of the universe.  
1620 Bacon publishes *New Organon*  
1625 The first arithmetic calculating machine is designed by schicard.  
1628 William Harvey describes the circulation of blood in the body  
1637 Descartes publishes *Discourse on method*  
1687 Newton's laws of motion in *Principia Mathematica*

### II- Obstacles to knowledge: Bacon's Four Idols

Bacon claims that error and lack of progress in science arise from a number of false notions. These notions or tendencies are called idols for they captivate the mind in the same way that worshiped idols take control of the mind of their worshipers. The idols are four kinds:

**Idols of the Tribe:** Weaknesses that are common to all humans. For example, the limitation of the five senses to detect micro objects and the tendency to imposes order in nature even when such order does not exist (XIV)

**Idols of the Cave:** weaknesses that are peculiar to individuals. For example, some people have a tendency to detect similarities in things while ignoring existing differences. Also some people have a tendency to adhere to a theory in a dogmatic manner ignoring its problems. (LIV)

**Idols of the market place:** weaknesses that stem from imprecise usage of language. For example, people uses terms like "Prime mover" or "fortune" even though these terms have no reference in reality. Also, people use terms such as humidity but with no clear definition. (LX)

**Idols of the Theater:** Philosophical theories which captivate its followers into seeing things in light of its concepts in a similar way to how plays captivate audience. For example, Aristotle's theory. (LXIII)

### III – Fighting idols: the Scientific Method

#### Induction:

Venus is a planet and it exerts gravity  
Mars is a planet and it exerts gravity  
Jupiter is a planet and it exerts gravity  
  
(prob) All planets exert gravity

#### Deduction:

All planets exert gravity  
Venus is a planet  
Therefore, Venus exerts gravity

In a deductive argument the conclusion follows necessarily from premises. But are these premises true? Where do we get these premises? Induction is needed to arrive at true premises. The catch, however, is that the conclusion of an inductive argument doesn't follow necessarily.

**Bacon's method:**

! "...derives axioms from the senses and particulars rising by gradual and unbroken ascent, so that it arrives at the most general axioms last of all"(XIX)

(1) Thorough and complete observations: tables of instances

(2) Experiments of all sorts: experiments of fruit aim at practical

Results while experiments of light aim is to increase knowledge

#### **IV- Scientists as "Bees": roles of observation and reason**

Although Bacon defends the uses of experiments and observations, he neither supports a method that only involves mindless gathering of data nor a method that produce empty theories without observations. The true method is one that employs both observation and theory, even if the initial step is data gathering.

"The men of experiment are like the ant, they only collect and use; the reasoners resemble spiders, who make cobwebs out of their own substance. But the bee takes a middle course: it gathers its material from the flowers of the garden...but transforms and digests it by a power of its own" ( XCV)

**Uses of reason:**

- 1- Comparison of positive and negative instances through a process of elimination.
- 2- crucial experiment: devising a hypothetical experiment or test in order to conform a given theory in comparison to other contending theories

#### **V- New Attitude to Knowledge**

Bacon states that societies and governments should have favorable attitude to science:

- 1- Need for cooperation , royal support, and funding for without such patronage science cannot progress(CXI)
- 2- Science must be transformed into a profession, not just a hobby practiced by amateurs (LXXX)
- 3- Science should be viewed as an increasing commodity , which accumulates over time (LXXIV, XC)
- 4- Although science is the "handmaid of God", the scientific activity should be separate from religion in terms of methods and explanations(LXXXIX,LXV)
- 5- Science is a useful instrument in conquering nature and political domination of the globe(CXXIX)

#### **VI- Problems with Bacon's method**

Is Bacon's method free from idols?