

Science and Society

A “soft skills course” for 3rd semester
undergraduates in commerce and
arts streams

Sharath Ananthamurthy
Department of Physics
Bangalore University

Scope and methodology

1. Aim of the course

- Whom is it intended for?
- How can it be taught?
- What are the learning outcomes?

2. Structure of the course

- Suggested lecture topics
- Emphasis

3. Readings, Preparation, Examination

Aim of the course

- To enable an educated view of the S&T enterprise, with basic knowledge of some of the key aspects of S&T **without specializing in science**
- To develop an ability for a critical analysis of S&T and to be able to interpret its interaction with society
- The course is **not** a “popular science” course
- Although in the sections some basic facts are given, the emphasis should be on interpretations and analysis with reference to society

Teaching

- Mainly a person qualified in a postgraduate discipline of science (coordinates and delivers most of the lectures)

BUT!

With a flair for the historical aspects of science and an appreciation that science is a HUMAN activity and is embedded in SOCIETY and affects the latter

The course coordinator may arrange other lectures by invited experts/ teachers from other disciplines

Learning outcomes

- Be able to have a basic understanding of what science is (and is not)
- Be able to appreciate and critically evaluate the S&T impact on our lives
- Be able to have an “educated guess” about the future course of technological evolutions
- Participate in the democratic process as educated citizens

Structure

The course can be broadly conceived as

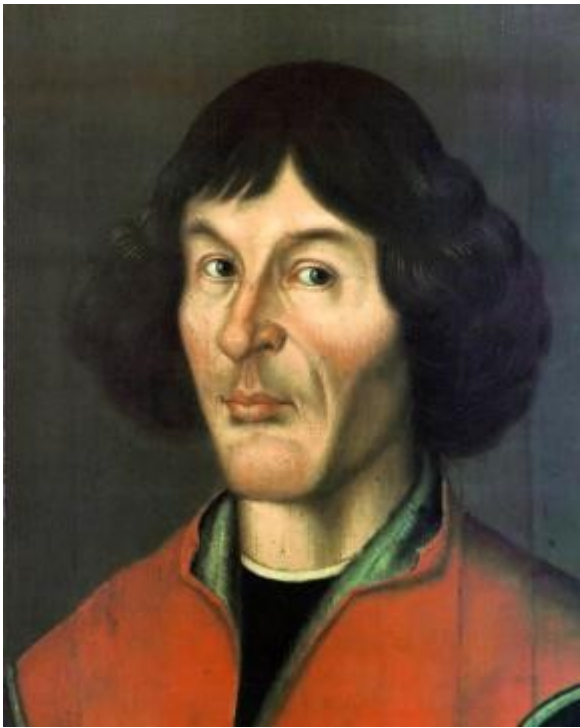
What is Science?

**Milestones of 20th and
21st Century Science**

**Impact on
economy and
society**

What is Science? (6 lectures)

- Heliocentrism, Galileo and observational science, Renaissance period in Europe
- Cartesian dualism (mind body separation)
- Reductionism
- Age of enlightenment
- Universe as a “mechanism”
- Science, mathematics in ancient India
- Modern notion of science
- Industrial revolution



Copernicus
(Heliocentric system)



Galileo

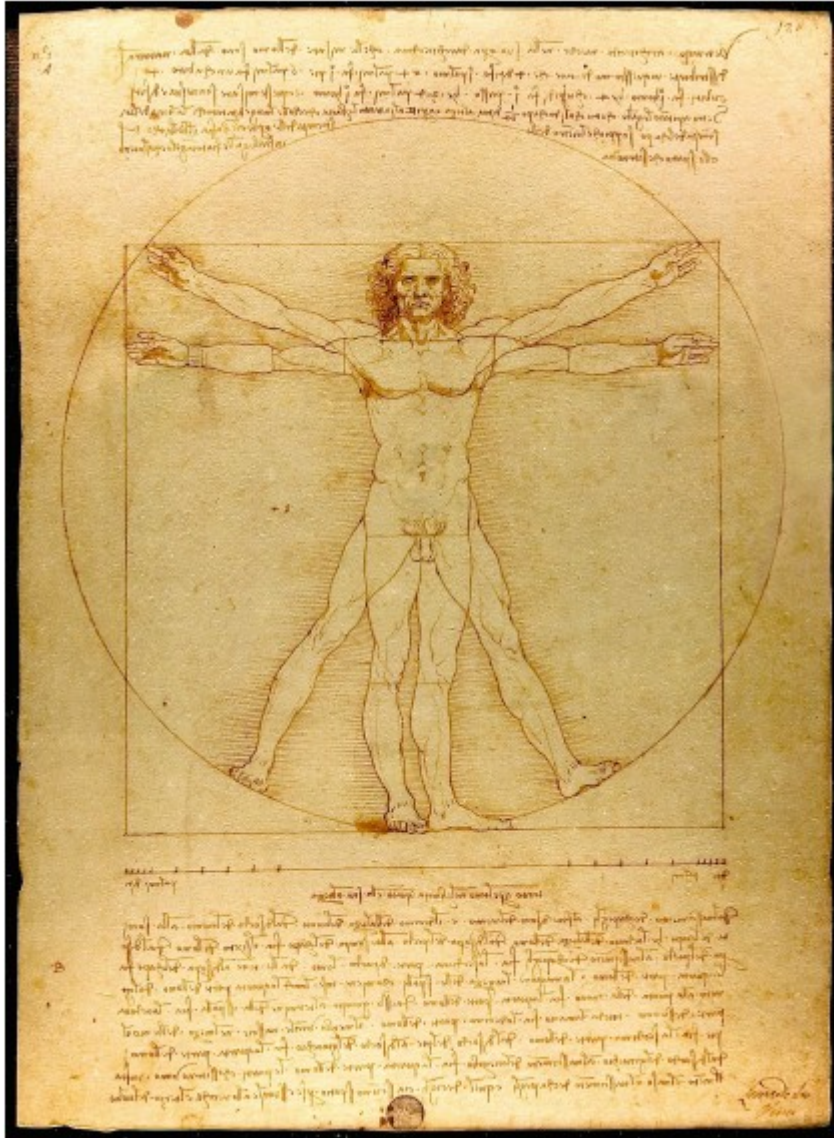


Kepler

The birth of modern astronomy

Galileo- Experimental observations as the basis for science

The Renaissance and its significance



- Leonardo Da Vinci
- Galileo
- Flowering of Art and Science

Galilean refractor being displayed in Venice



Science & Society workshop, Sharath Ananthamurthy



Rene Descartes

17th Century

Cartesian Dualism (in “Discourse on the Method”)-Separation of mind and matter
Possible to know about the world through deductive reasoning alone.

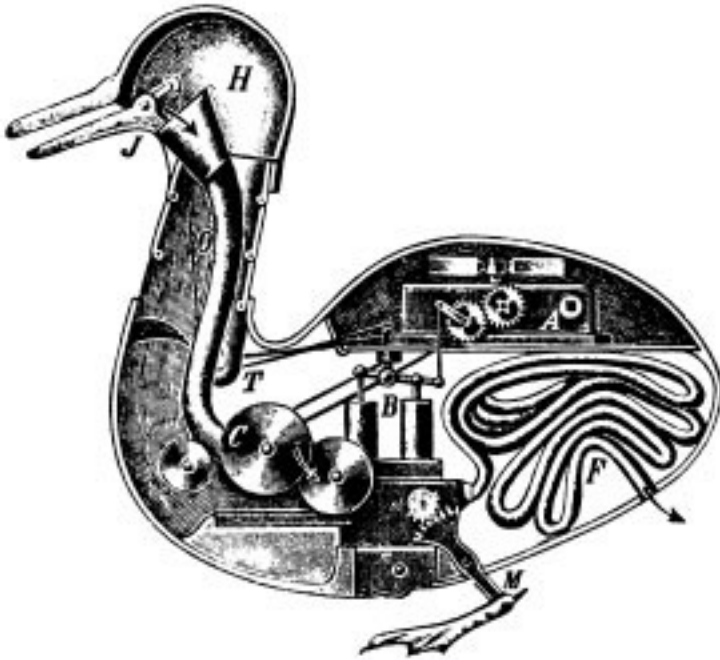
Separation of the divine, in this process

Analytical Geometry developed by him

Science & Society workshop, Sharath Ananthamurthy

Reductionism

Descarte's proposal that for any matter living or non living (except humans) one could study the system as if it is composed of different working mechanical parts.



Mechanistic View of Nature

Conceiving the universe as a giant “clockwork mechanism”

Other periods in history important for science

- **Age of enlightenment (18th century)**

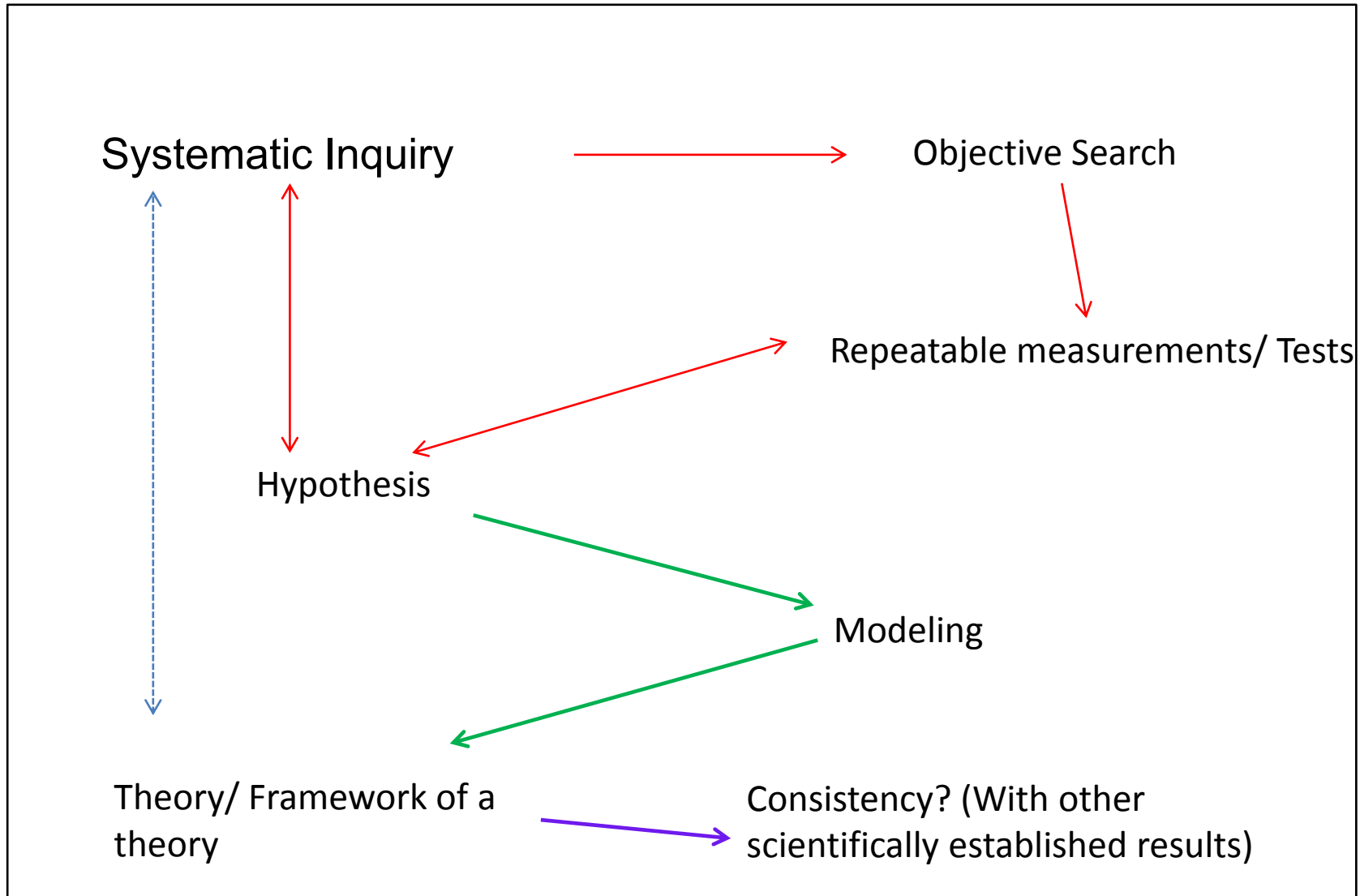
Importance of reason, analysis over traditional figures of authority

- **The industrial revolution and technology for mass production (19th century)**

What is Science? – Verifiability OR Falsifiability

- **Positivist** view of scientific method- Verifiability is an important criterion
- **Karl Popper**- Not verifiability but rather falsifiable statements useful in science
- Example- Assertion that “all crows are black” is in practice non verifiable since we can never be sure that we have looked at the complete set of crows that exist or will exist
- On the other hand even one counter example of a non black crow can make the above statement false
- Also tautologies such as “ A crow is a bird that is black” has no value

What is Science? (Accepted view of a scientific method)



Science in non-western cultures

- Mathematics/Astronomy in ancient India
- Vyakarana- Panini
- Medicine/ Surgery (Charaka, Sushruta)
- Metallurgy (Damascus steel, Iron smelting, coins)
- Hindu/Arabic numerals

How S&T are interdependent (3 lectures)

- Laser as an example of a tool that has driven many scientific applications



How S&T are interdependent

- Microscopy and applications (1 lecture)
- Germ theory of disease, Vaccinations (Contributions of Robert Koch, Edward Jenner, Louis Pasteur) (1 lecture)

Science and the public (1 or 2 lectures)

- Discussion on science education
- Spending on Science and Technology
- Public audit of S&T- enabling this
- Science and Technology in Indian environment

Unit II: Examples

- **Lectures on following topics:**
 - Evolution of species
 - Antibiotics
 - Soaps, Chemicals, Plastics
 - Atomic energy, Nuclear power plants, Fission
 - Space exploration, Remote Sensing (India)
 - Genetics and human health
 - Nanomaterials, Smart materials

Unit III: S&T-social impact

- Green revolution
- White revolution
- IT revolution and connection with India
- Renewable sources of Energy; Impact on environment
- Climate change
- High technology and impact on human psyche