HISTORY OF METHODS
LOOKING BACK AT THE PATH TO KNOWLEDGE

Main topics

Epochs of scientific methods
Critique of the historical development and our status quo
Interaction of scientific methods with philosophy and society

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UNDERSTANDING THE FUTURE OF SCIENCE
BY LOOKING AT THE PAST

Central building
Reflexive, Inter- and trans-disciplinary, normative, sustainable

→**Henrik von Wehrden - Different pathways to knowledge**

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THEORY, TOPICS AND METHODS

- People are often driven by topics
- Theories often start in one discipline, but then reach further
- Methods are often the heart of the dogma of disciplines

- Learning methods takes time
- For methods experience is more important than knowledge
- Most researchers learn few methods

WHAT IS A SCIENTIFIC METHOD

Scientific methods can be either reproducible and learnable, can be documented and are learnable, or are together reproducible, can be documented, and are learnable.

Gathering, analysing and interpreting data.

Methods often have a specific language, and are nested within disciplines

Our oriental heritage

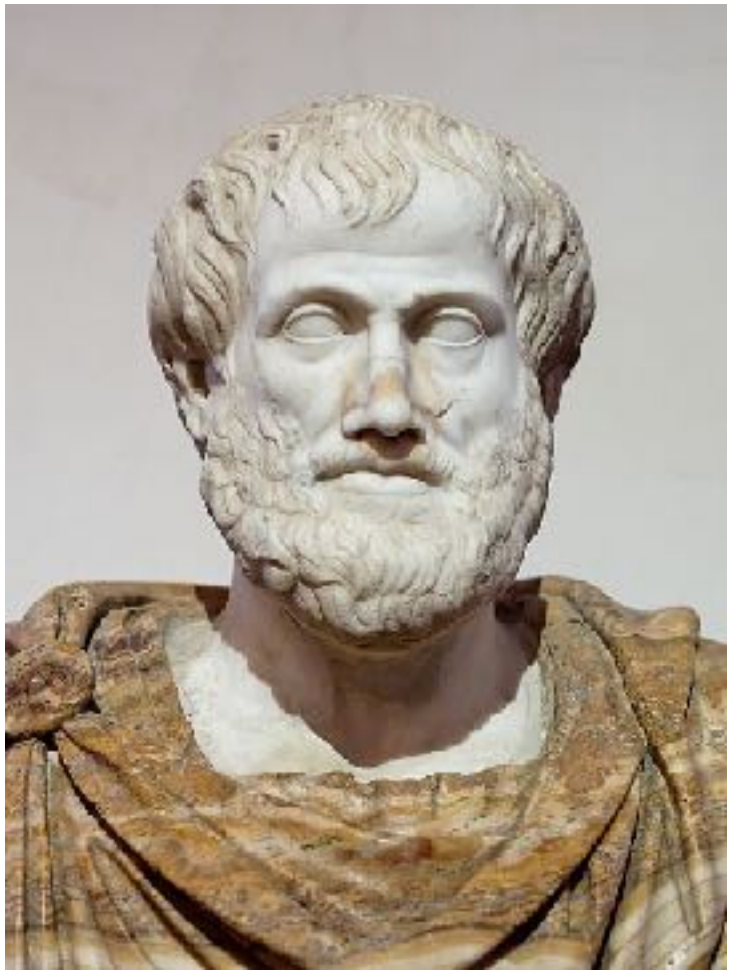
India -mathematics, medicine, logic

Babylonia - Mathematics, Astronomy, Medicine

Egypt - Mathematics, Astronomy, Medicine

Persia - Chemistry, physics, astronomy, medicine, mathematics, literature studies

The antique: Observe and understand



Ethics

Ontology

Logic

Mathematics

Astronomy

Meteorology

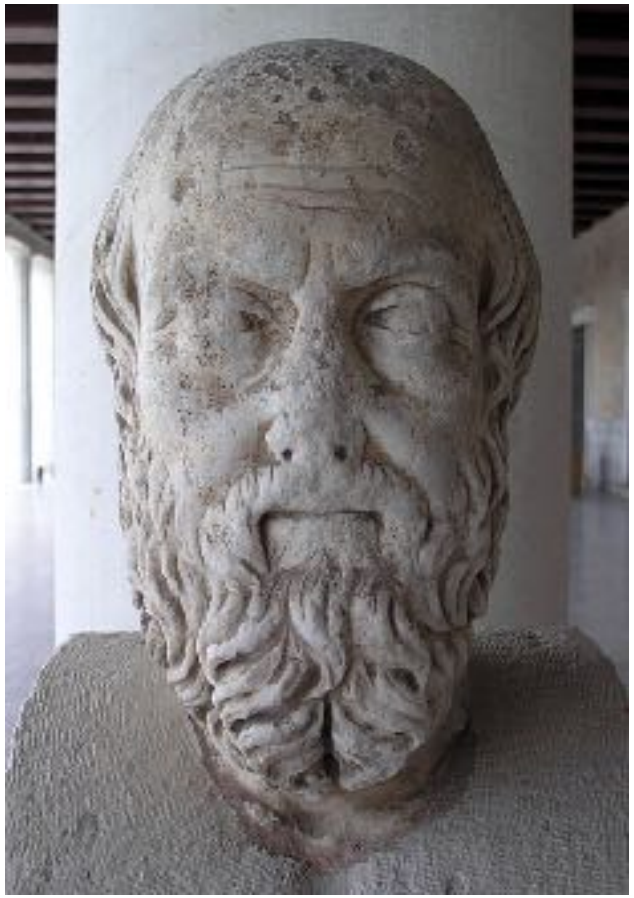
Geology

Psychology

Zoology

Medicine

The antique: Observe and understand



Herodot

Observation & description
Geography
Story-telling
Bias

The antique: Observe and understand

Ibn al-Haytham

Optics
Scientific questioning
Experimental observations
Mechanics

Before the age of reason: Measure and solve

Paintings
Journals & Notebooks
Anatomy
Engineering

Leonardo Da Vinci

Before the age of reason: Measure and solve

Mercator

Before the age of reason: Measure and solve

"It is futile to do with more things that which can be done with fewer”

William of Ockham

Age of reason: Pathway to scientific disciplines

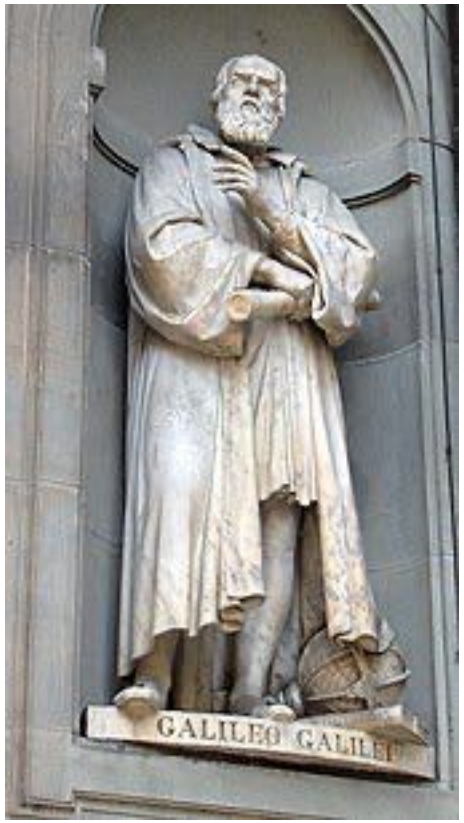
Astronomy

Physics

Engineering

Questioned existing paradigm

Paved the way to the scientific method



Galileo Galilei

Age of reason: Pathway to scientific disciplines

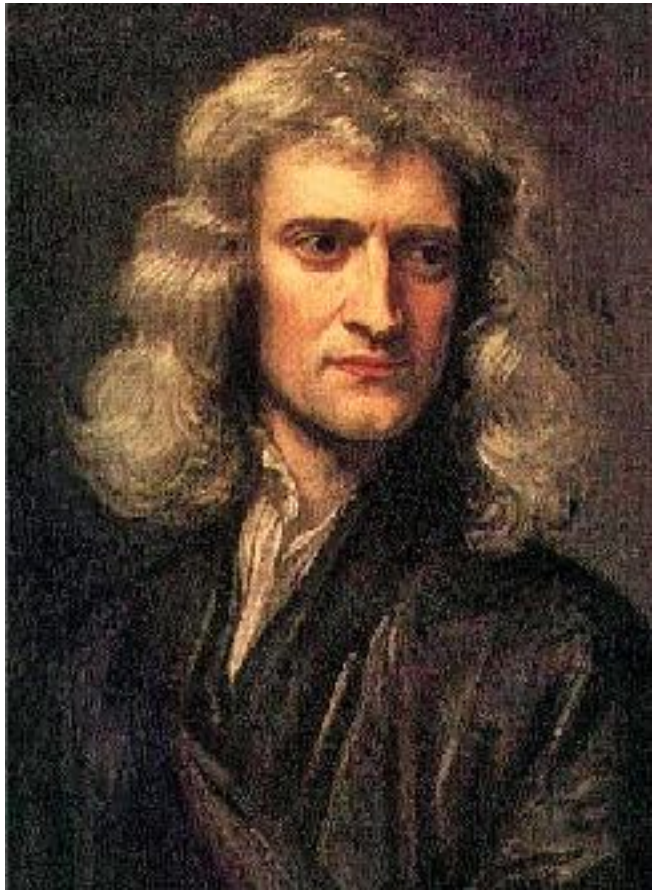
Mathematics

Physics

Astronomer

Natural Philosophy

Engineering



Isaac Newton

Age of reason: Pathway to scientific disciplines

Learned academies

Journals

Norms in science

Descriptions of nature

Colonialism

Constructed society

Charles Darwin

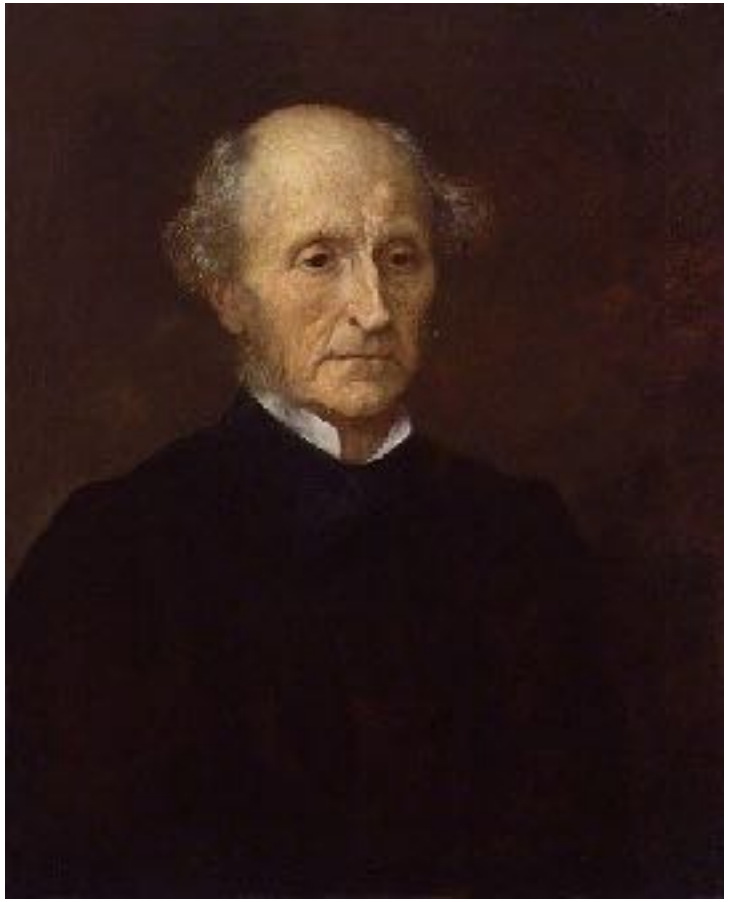
Age of reason: Pathway to scientific disciplines

Utilitarianism

Maximise happiness

Double book-keeping

Induction and observation



John Stuart Mill

Age of reason: Pathway to scientific disciplines

Distinction of the analytic and synthetic

Reason is a source of morality

Path to atheism

Kant

Age of reason: Pathway to scientific disciplines

Philosophy:

Reason

Social contract

Utilitarianism

Engineering

Medicine

Agriculture

Natural sciences

Astronomy

Physics

Zoology & Botany

After the wars: The rise of agency and holistic models

Karl Marx
Critique of society and capitalism

Carl Hempel
Science of deduction

Wittgenstein
Language vs. reality and
the limits of science

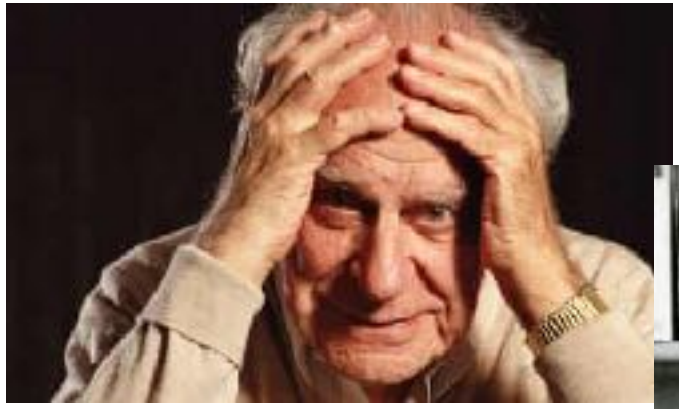
After the wars: The rise of agency and holistic models

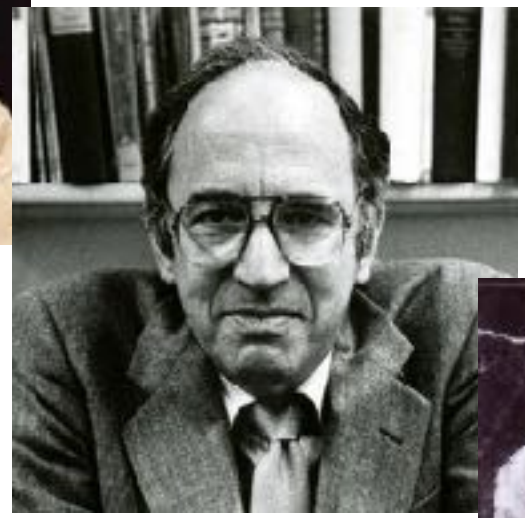
Critical Theory

Karl Popper - critical rationalism

Thomas Kuhn - Scientific paradigms

Paul Feyerabend - Against methods





Internet and computers:
The new science of interconnectedness

Interdisciplinarity - Julie Klein

System thinking - Elinor Ostrom

Critical Realism - Roy Bhaskar

Ethics - Derek Parfit

TIERS OF DISCIPLINES

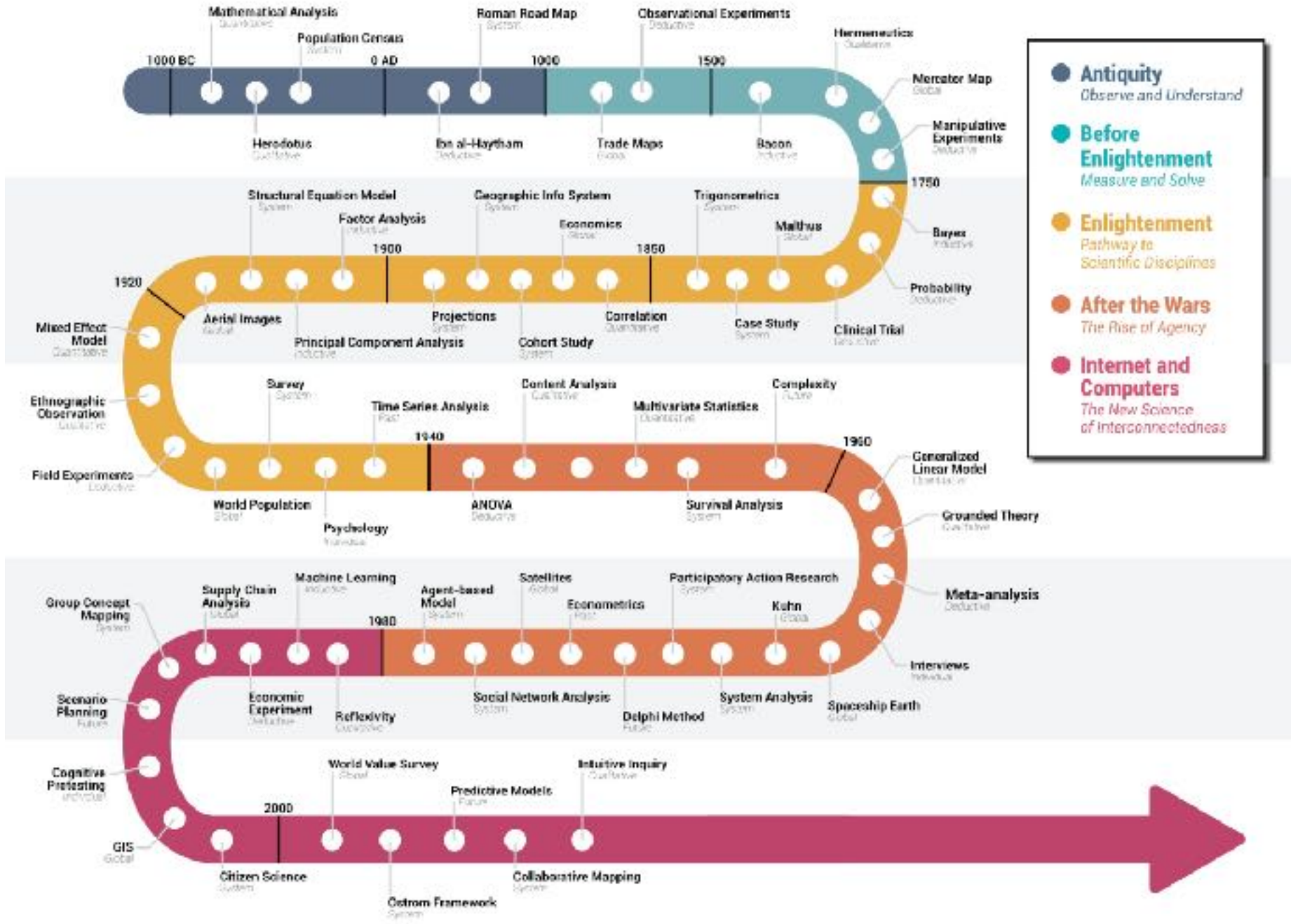
1st tier: **Philosophy**: Reason, Social Contract, Utilitarianism. Also: Natural World, Mathematics, Logic

2nd tier: Psychology, Cultural -, Political -, Social sciences, Legal studies, Economics

Also 2nd tier: Physics, Biology, Geology, Medicine

3rd tier: Ecology, Sustainability science, Data science

Timeline of Methods



SUMMARY

- Methodology began to differentiate itself in the antique already, and more and more disciplines were formed since the enlightenment.
- These scientific disciplines formed methodological dogmas that crumbled over the last 100 years, being either criticised or re-enforced.
- What matters now the most is whether collaboration and tolerance between the diverse strata of knowledge is possible, and how we go on.
- Sciences are not independent of other sciences, philosophy, and especially not of society. Instead science builds on responsibility, collaboration and joined learning.

FURTHER READING

- Must read: https://plato.stanford.edu/entries/thomas-kuhn/#DeveScie (Number 2,3 & 6.5)

- Could read:
- Thomas Kuhn: The structure of scientific revolutions
- Theory and Reality: Peter Godfrey-Smith
- Paul Feyerabend (1993). Against method.
- Derek Parfit (1984). Reasons and persons.
- ….

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