Lecture 2
Aristotle

GFN1000 In Dialogue with Nature

Content

- Aristotle
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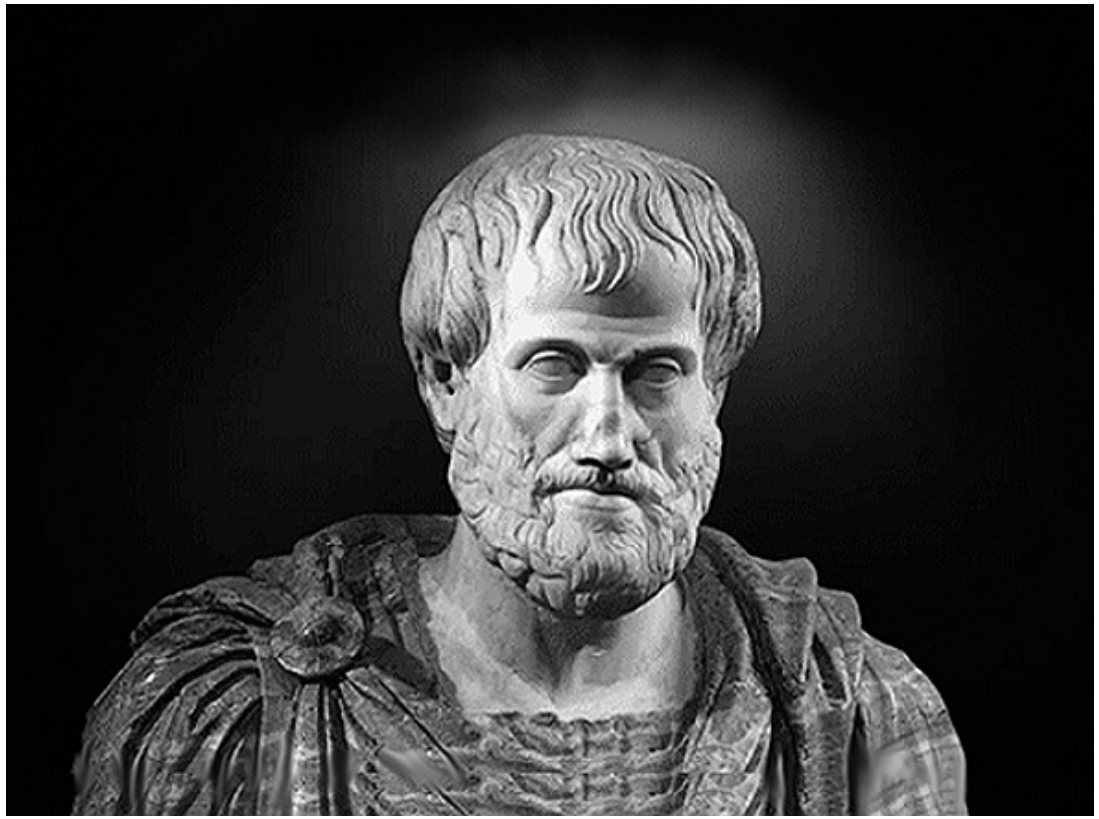
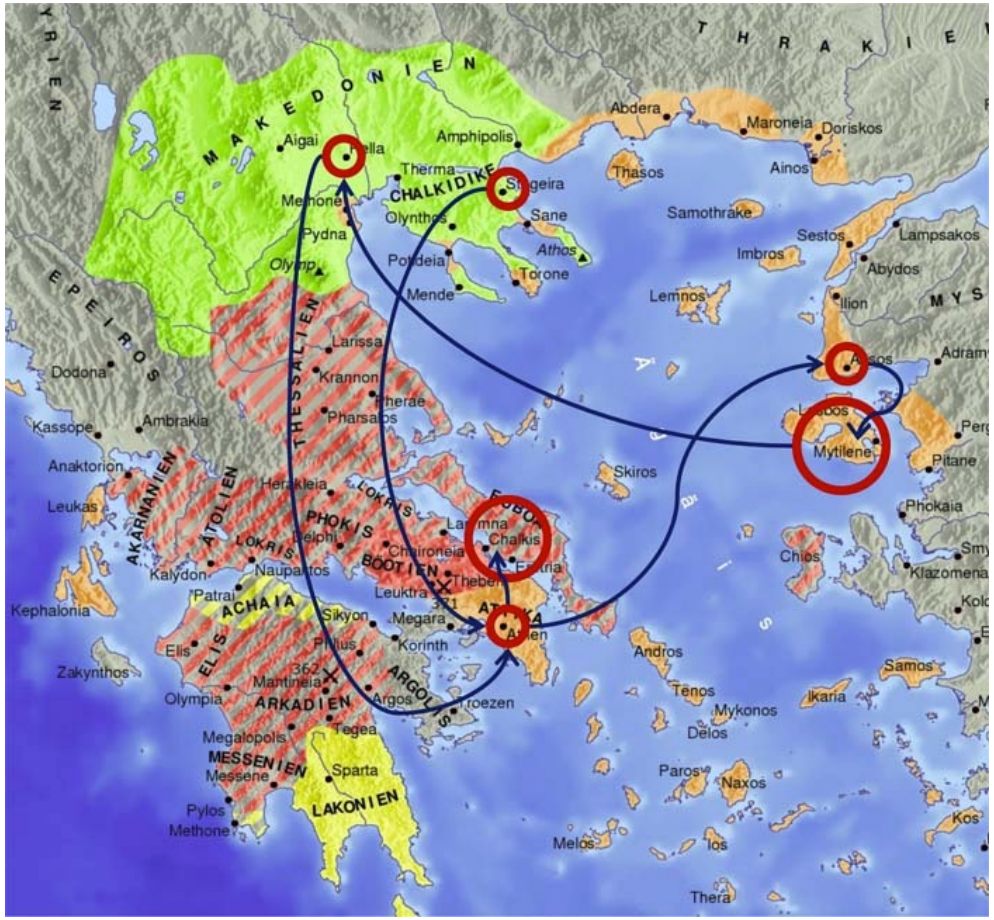
  - His Works
- Aristotle's Natural Philosophy
  - Matter and Form
  - Change and Motion
  - Causation and Teleology
- Empiricism
  - Falsification



Aristotle (384-322 BCE)

- Born in Stagira in northern Greece
- Joined the Academy at 18, left at 37 after Plato's death in 347BC
- Alexander's education under Aristotle was during the age of 13-16.
- Established the school of Lyceum at 49; fled Athens at 61 in 323 BC when Alexander died



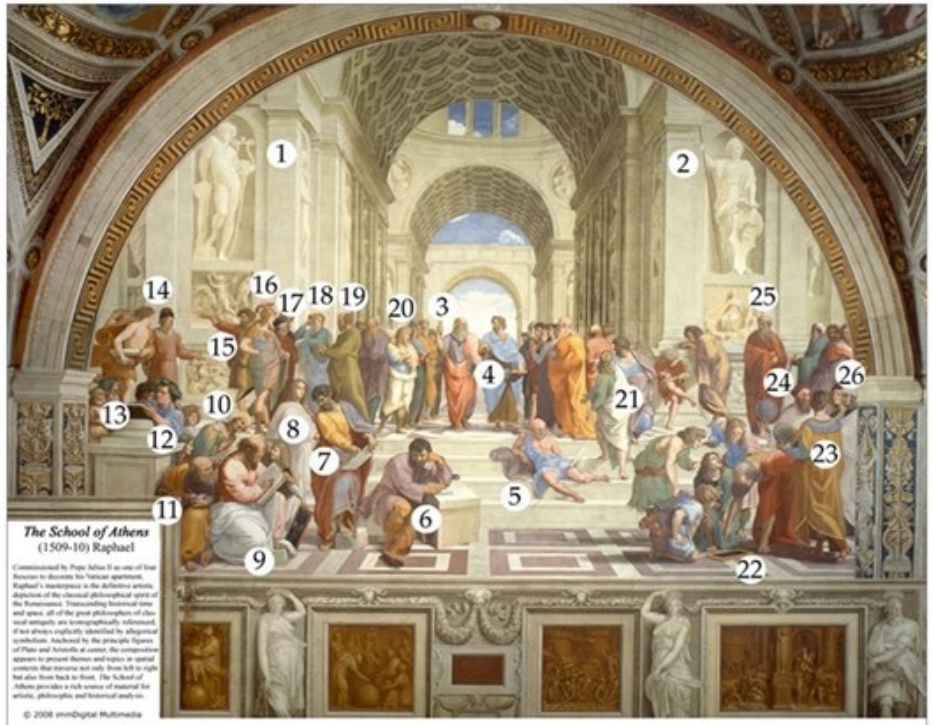
Aristotle and Alexander the Great

- Aristotle's father was the royal physician to Alexander's grandfather.
- Alexander the Great and the Hellenistic Age
  - Hellazein: to speak Greek and/or identify with the Greeks
- Aristotle taught Alexander the Great medicine and science; Alexander supported Aristotle financially
  - The two became estranged later.

The Foundation of Western Natural Philosophy

- What we have as Aristotle's works are about 30 closely written, terse, treatises on a full range of philosophical and scientific topics.
  - These may have been his lecture notes, or even his student's notes.
- His writings cover metaphysics, poetry, theatre, music, logic, rhetoric, linguistics, politics, ethics, **physics**, **biology**, and **medicine**.
- Aristotle's works laid the groundwork for the **systematic** development of natural philosophy and the basic framework for the understanding of nature.
  - "Aristotle was the first genuine scientist in history ... [and] every scientist is in his debt."(Encyclopædia Britannica)

Amicus Plato, Sed Magis Amica Veritas

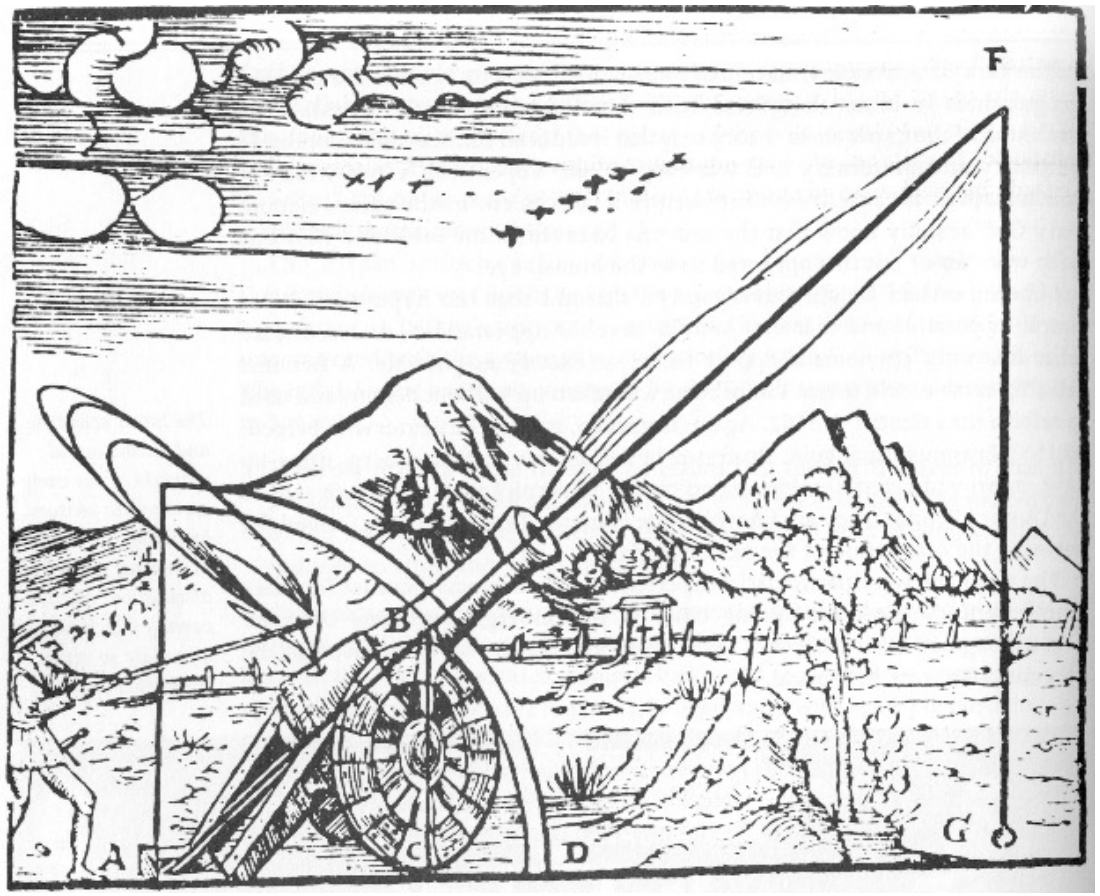


1. Apollo, god of truth, music, poetry
2. Athena, goddess of reason, wisdom
3. Plato (modeled by Leonardo da Vinci)
4. Aristotle
5. Diogenes (Socrates?)
6. Heraclitus (modeled by Michaelangelo)
7. Parmenides
8. Hypatia
9. Pythagoras
10. Averrões
11. Anaximander
12. Epicurus
13. Zeno of Citium or Zeno of Elea
14. Critias of Athens & History muse?
15. Æschines?
16. Alcibiades? Alexander?
17. Xenophon? Antishenes?
18. Alexander? Xenophon?
19. Socrates (Anaximander?)
20. Sappho of Lesbos?
21. Crito & Apollodorus?
22. Euclid or Archimedes
23. Ptolemy
24. Strabo or Zoroaster
25. Plotinus? Diogenes?
26. Apelles & Protogenes
(Raphael & Il Sodoma or Perugino)

The School of Athens by Raphael

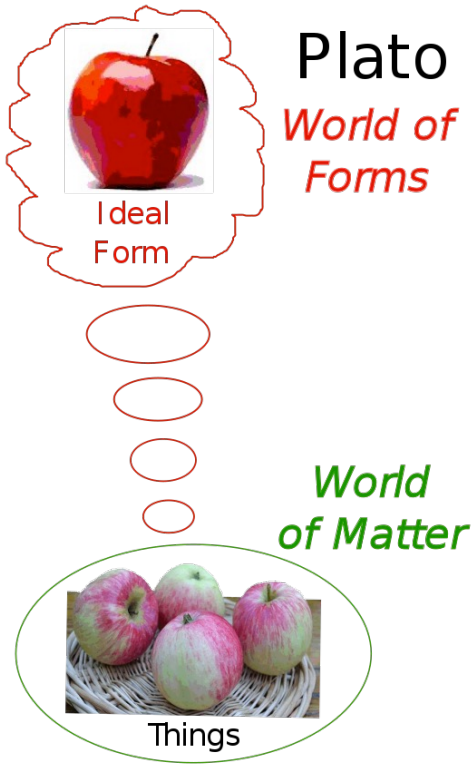
Aristotle's Physics

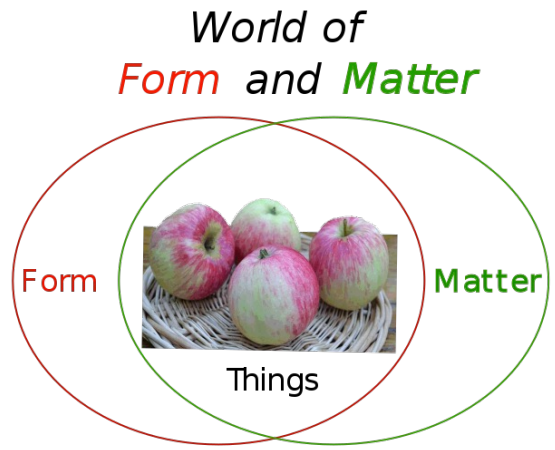
- Aristotle's theory of the nature of things – especially of change.
- *Phusei*: things that grow; things that exist by nature or are due to nature (e.g., living organisms, animals, and plants)
- Almost entirely accepted until the Copernican revolution (16C): the standard view of the world for 2,000 years.



Substance: Matter and Form

- Substances (*ousia*) are the ultimate things. Substances are a combination of form and matter.
  - Form is the structure
  - Platonic form vs. Aristotelian form
  - Matter (*hyle*) is the physical stuff that has certain properties
- Matter and form cannot be separated, but are intellectually distinct.





Change: from Non-being to Being

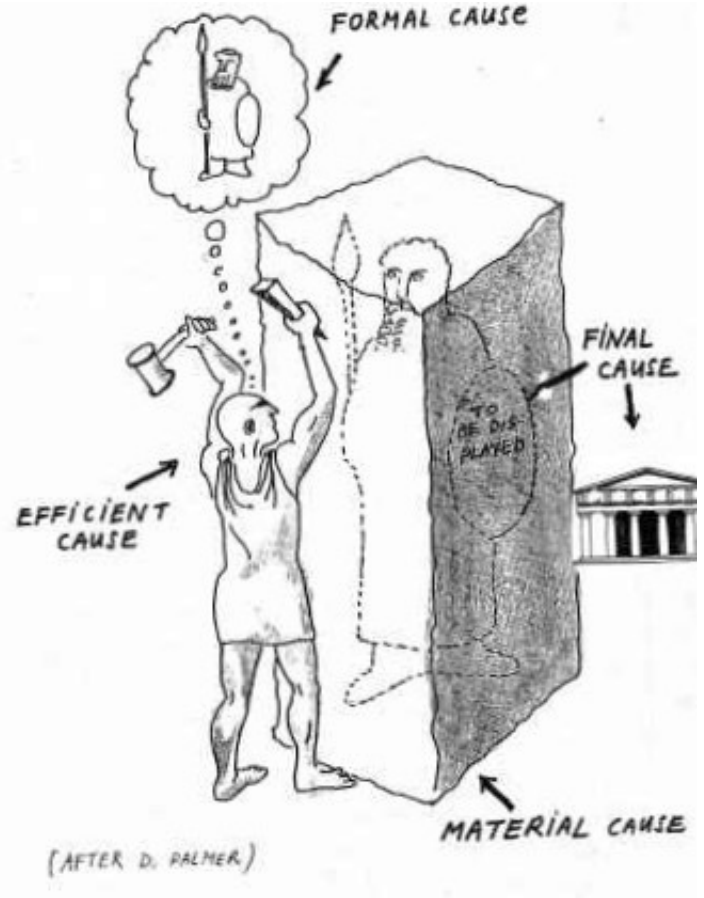
- Parmenides vs. Heraclitus
- Potentiality (*dunamis)*: the ability to become something else and has inherent qualities
- Actuality (*energeia)*: the fulfillment of the potentiality
- The nature of everything is to realize its potentiality.
  - Artificial objects do not have their nature; only natural things do.
  - Experiments intervene in nature.

Aristotle on Motion (*kinesis*)

- Natural motion: elements tend to seek their **natural** place
- Violent motion: any forced motion that opposes natural motion
  - Requires application of **external** force; as soon as the force ceases the motion ceases
- There is no motion without a **mover**.
  - Celestial motion: the Prime Mover(Unmoved Mover)
- Aristotle's conceptual framework contained no mathematical description as a **quantifiable measure** of motion (kinematics), but only gave the **causal explanation** of motion (dynamics).

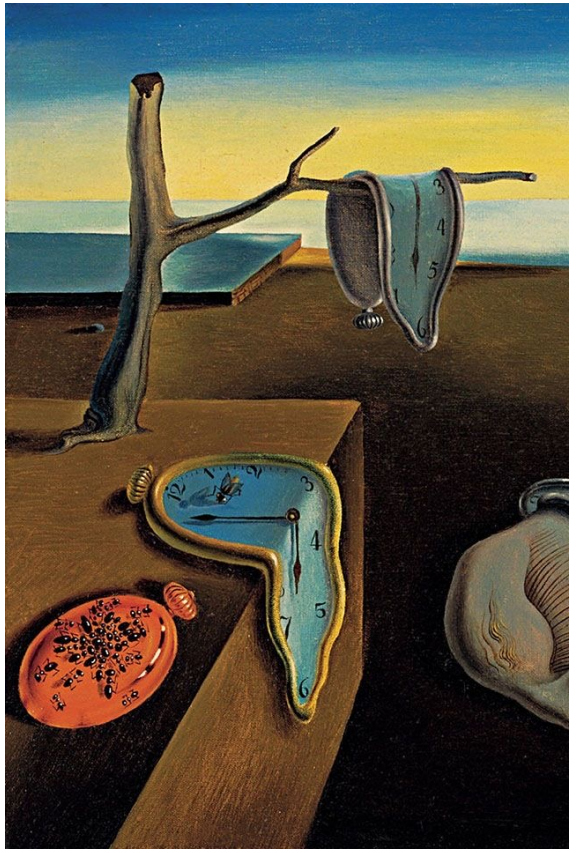
The Four Causes (*aitia*)

- Two approaches: Axioms → Propositions vs. Causes ← Natural Phenomena
- Aristotle claims that all changes simultaneously have four causes.
  - Material cause: what is it made of?
  - Formal cause: what is its form/structure?
  - Efficient cause: what is responsible for its coming to be or changing?
  - Final cause (*telos*): what is its purpose?



Aristotelian Teleology

- Teleology vs. Naturalism
- A teleological account of a subject matter is the view that the subject matter has a **pre-given** telos.
  - A denier of the teleological account may claim that things do not have a **pre-determined purpose**.
- Teleological explanations were dominant until Charles Darwin.
  - “Linnaeus and Cuvier have been my two gods, though in very different ways, but they were mere schoolboys to old Aristotle.”



The Persistence of Memory by Salvador Dalí

The Telos of Human

- The Rational Animal
  - "All men, by nature, desire **to understand**. An indication of this is the delight we take in our sense." (Metaphysics, 980a21).
- The Political Animal
  - "He who is unable to live in society, or who has no need because he is sufficient for himself, must be either a beast or a god." (Politics, 1253a27)

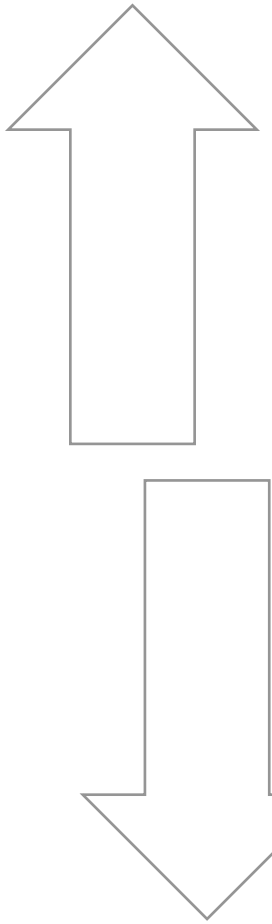
Rejecting Atomism

- Atomism: the origins of everything from the interaction of indivisible, homogenous bodies
  - *Atomos*: **uncuttable**
- Regarded by Aristotle as a chief competitor to teleology
  - Aristotle: all materials are made of the **four elements** of matter (earth, fire, water, and air)
  - **Vitalism**: the nature of life results from a vital force peculiar to living organisms

Democritus by Diego Velazquez

Empiricism vs. Rationalism

- Empiricists urge us to trust our senses, observe the world carefully, and learn from experience.
- Empiricism is usually opposed to rationalism - the view that reason rather than observation is the source of knowledge.
- Empiricism is a reaction and liberation from religious dogma: if you can't see it, feel it, measure it - it can't be verified. **Seeing is believing** and not the other way around.

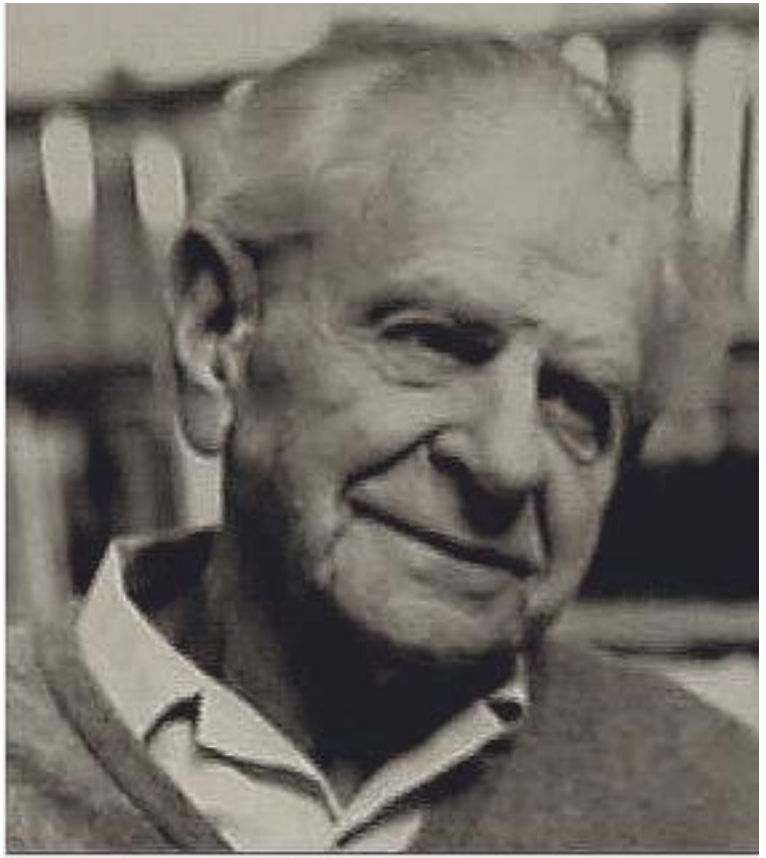


Plato separated world of sense from world of forms.

Aristotle rejected the idea of form as separate reality.

Falsifiability: Popper's Scientific Principle

- Karl Popper proposed falsifiability as the criterion with which to demarcate **empirical science** from nonscientific pursuits such as logic, mathematics, metaphysics, and pseudoscience.
- The **more falsifiable** the theory, the more preferable it is as a **scientific** theory. The empirical content of a theory increases with its degree of falsifiability.



Sir Karl Popper (1902-1994)

Can We Trust Our Senses?

Two questions John Locke (1632-1704) considers important:

- Can we know that things continue to exist during the intervals that they are not being observed by anyone?
- Even during the times that we are directly observing an object can we know for sure that the object actually exists?

- 先生遊南鎮，一友指巖中花樹問曰：「天下無心，外之物：如此花樹，在深山中自開自落，於我心亦何相關？」先生曰：「你未看此花時，此花與汝心同歸於寂：你來看此花時，則此花顏色一時明白起來：便知此花不在你的心外。」

——王陽明《傳習錄》
(1472-1529)