History & Philosophy of Science

Erasmus Programme

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Definitions

- History
- Philosophy (Ontology – Theory of Knowledge/ Epistemology – Ethics)
  - Ontology concerns the nature and the origin of the world (Presocratics, Aristotle), the nature of God (Aristotle), the nature and the origin of human being (Socrates/ Plato)

Definitions (cont.)

- Philosophy
  - Epistemology deals with the credibility of human knowledge. What kind of things can we know? Is what we consider as knowledge indeed knowledge or only a human attempt for knowledge? Which are the criteria of a scientific knowledge?
  - Ethics deals with the ‘right’ human behavior

Epistemology

- Epistemology ≡ Philosophy of Science
- Criteria of a theory to be considered as scientific
  - Induction (scientific syllogism) vs Deduction (rational syllogism)
  - Induction as bottom-up strategy: from many sensory observations leading to a universal scientific law
  - Induction (logically invalid but extending the knowledge) vs Deduction (logically valid but just organizing the existing knowledge)
  - Refutability (a scientific proposition is refutable in opposition to a philosophical or religious opinion)

Epistemology (cont.)

- Criteria of a theory to be considered as scientific (cont.)
  - Subject to further testing (observations/ experiments)
  - Covering all the cases without exception

Modus Tollens

- The argument form: p=>q implies that

  NOT q => NOT p
- p is a theoretical (scientific) proposition
- q is an empirical proposition, which can be affirmed or denied through observation or experimentation
- Method: the refutation of a scientific theory through the refutation of an empirical consequence of the theory

Mathematics

- a formal tool for computations
- a thing in the borders between philosophy and science
- a mathematical theory is a consistent (not contradictory) set of propositions
- Structure: axioms, theorems
- A mathematical structure, like the Euclidean geometry, cannot be refuted (deductive logic).

History of Science

- Presentation of decisive scientific discoveries aiming at the understanding of the operating laws of the universe including the motions of the heavenly bodies, the inorganic and organic forms of matter, the physiology of the animals, the nature of the human mind, the human psychology…
- Analysis of the historical background, special personality of each scientist, philosophical – religious – scientific influences, conceptual leaps, consensus of the scientific community, conservatism and rigidity of the social, religious and also scientific framework

Deep in the past towards now

- Babylonian/ Egyptian/ Greek astronomy and mathematics
- The discovery of the cycle of Meton (lunar-solar calendars)
- The establishment of Science with the Presocratics
- Socrates – Plato - Aristotle
- Hellenistic times in the Museum of Alexandria: the peak of sciences (Euclid, Archimedes etc)
- Scientific Revolution (Copernicus, Kepler, Galilei, Newton)
- The Theory of Relativity of Einstein and Quantum Theory
- The Standard Model in the Microcosm of particles and the various cosmological models of the Universe

Exercise

- Select a personality (scientist) and give us a presentation (in ppt) of his/her life and his/her main scientific accomplishments.
  - about 20 slides
  - References
  - Bibliography