

Phil 1103 Review

Also:

- Scientific realism vs. anti-realism
- Can philosophers criticise science?

1. Copernican Revolution

Students should be familiar with the basic historical facts of the Copernican revolution.

- Details of the Ptolemaic and Copernican models (and Tychonic as well)
- The empirical data used to support and reject these models (e.g. retrograde motions, absence of stellar parallax, phases of Venus).
- Non-empirical arguments from “harmony”, as well as religion and philosophy.

2. Empiricism and Rationalism

- What are empiricism and rationalism?
(experience only, 'lay your notions by', etc.)
- How does empiricism lead to the problem of induction?
- What solutions have been offered to the problem of induction?

3. Deduction and Induction

- Identify hypothesis, data, and relevant background assumptions.
- Separate the empirical from theoretical content of a statement (as far as possible)
- What is the basic difference between deductive and inductive arguments?
- (Also, inductive arguments require a paradigm.)

4. Falsificationism

- Popper argued that scientific arguments are not inductive, but instead *deduce* that a hypothesis is false.
- Students should understand the Duhem problem.
- Popper has other problems, and his view arguably leads to anti-realism.
- What is an *ad hoc* hypothesis?
- What does Popper say is the difference between scientific theories and metaphysics?

5. Cause and Effect

- What is the difference between causation and correlation?
- What patterns of causal connection commonly account for correlations?
- How is causation linked to explanation?

6. Inference to the best explanation

- IBE means believing (to a suitable degree) the hypothesis that is the best available explanation for the total data.
- The strength of an explanation depends on
 - (i) the degree to which it *predicts* the data, and
 - (ii) the degree of *plausibility* that the hypothesis has, relative to background ideas only.

6. Inference to the best explanation

- IBE says that theory is *supported* by the evidence only to the degree that it *predicts* the evidence.
- Popper agrees that a scientific theory must *predict* the data, at least to a high degree.
(It isn't enough that the data be *consistent* with the theory. A flexible theory will be consistent with virtually all possible data.)

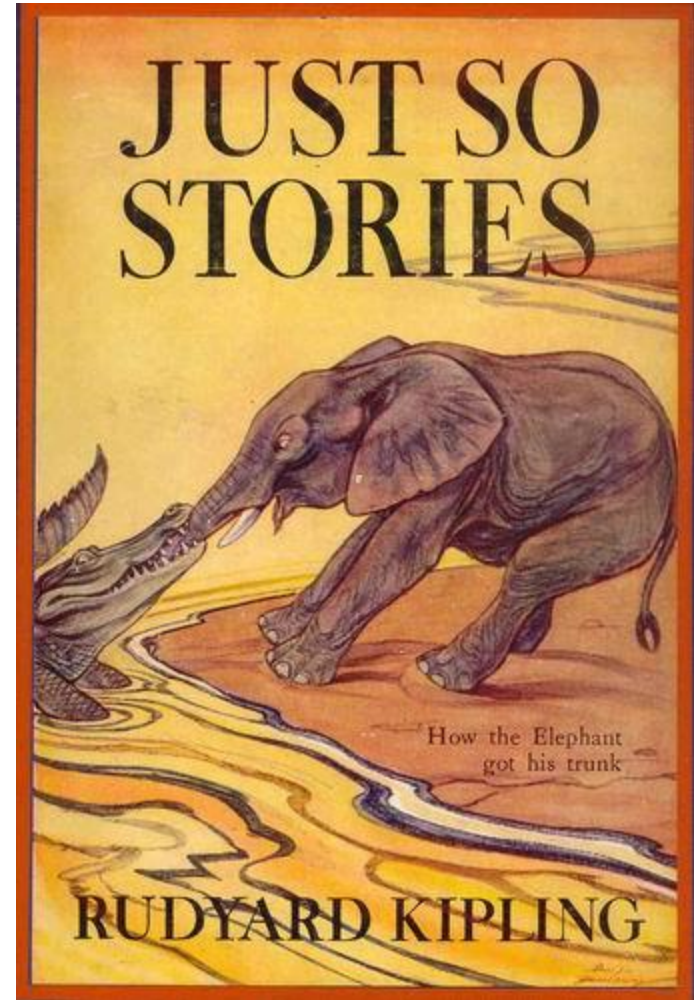
“Firstly, evolutionary theorizing is rarely sullied by any specific predictions or retrodictions concerning organic events at any level of biological organization.

Secondly, the theory seems to possess a disquieting amount of elasticity or flexibility with regard to explaining organic phenomena. Anything and everything in the empirical biological world seems to be compatible with evolutionary explanations. Refuting evidence or crucial experiments that could realistically jeopardize an evolutionary account seem extremely few and far between.”

Arthur Caplan, *Erkenntnis* 13 (1978) 261-278.

E.g. Stephen Jay Gould (1980) said:

“Rudyard Kipling asked how the leopard got its spots, the rhino its wrinkled skin. He called his answers “just-so stories.” When evolutionists try to explain form and behavior, they also tell just-so stories—and the agent is natural selection. Virtuosity in invention replaces testability as the criterion for acceptance.”



- Caplan himself rejects this criticism of evolutionary theorizing:

“Nor does it seem fair to demand high philosophical standards of testability, systematic power, and predictability of scientific theories that seem to adequately serve the explanatory needs of empirical scientists for purely logical or philosophical reasons. The logical analyses of philosophers of science, which were undertaken as purely descriptively adequate enterprises, may have grown prescriptively unwieldy.” (p. 277)

- In other words, biologists are happy with their theory, so philosophers of science should *lay off*.
 - But are the philosophers’ analyses of science meant to be purely descriptive?

6. Inference to the best explanation

- IBE endorses a version of the 'Sherlock Holmes Rule'.
- Is this rule valid?
- How could it possibly go wrong?

7. Kuhn's ideas

- What is a paradigm? Why does each branch of science need a paradigm?
- Difference between normal science and revolutionary science.
- Theory choice always involves a subjective element, but especially choice of a paradigm does.

- Difference between observation and theory is blurred.
- In some cases, the meaning of a scientific term changes during a revolution.
- Science is demarcated from non-science in that science (i) has a shared paradigm, and (ii) problems with the paradigm create a sense of crisis.

8. Realism and Anti-realism

- Realism says
 - (i) There is an objective world, existing independently of our theories, and
 - (ii) We are able to acquire (approximate and fallible) knowledge of the world. I.e. the world *corresponds* (at least roughly) to our best theories.

Anti-realism denies either both, or just (ii).

Anti-realism

- Kuhn seems to espouse two forms of anti-realism (or *relativism*).
 - (A) Epistemic anti-realism: whether or not a view is *rationally justified* depends on your paradigm. It is not an objective matter.
 - (B) Metaphysical anti-realism: There is no objective *truth*, no world “out there” that is independent of theory. “Reality” is in fact a social construct. (Kuhn compared the ‘progress’ of science to biological evolution. Science *changes*, but doesn’t get *better*. It has no goal.)

“We may, to be more precise, have to relinquish the notion, explicit or implicit, that changes of paradigm carry scientists and those who learn from them closer and closer to the truth” (p. 170)

(Notice the weasel word ‘may’ here?)

“Does it really help to imagine that there is some one full, objective, true account of nature and that the proper measure of scientific achievement is the extent to which it brings us closer to that ultimate goal?”

(Notice the rhetorical question?)

- Kuhn claims that he can't even make sense of talk about what is "really there" in the world itself, as opposed to what is there according to some theory.
- Does acceptance of the earlier parts of Kuhn commit us to either form of anti-realism?

The Pessimistic Meta-Induction from Past Scientific Failures

- Larry Laudan: If you look at the history of science, one finds that all scientific theories, even very successful ones, are eventually rejected as false. (A “graveyard” of dead theories.)

E.g.

- Newtonian mechanics and theory of gravity.
- Phlogiston chemistry.
- Fresnel’s wave theory of light.
- Ptolemy’s astronomy.

Discarded ontology (objects)

In particular, many of the objects that existed according to past theories (i.e. the “ontology” of those theories) have now been rejected.

- Newtonian mechanics had an ontology of absolute space (understood by Newton as the “sensorium of God”) and absolute time.
- Fresnel’s wave theory of light was based on the “luminiferous ether” – an elastic solid filling all of space.
- Copernicus’s astronomy retained the “crystalline spheres”.

Approximate truth?

- One response to the pessimistic meta-induction is to say that these successful past theories, though technically false, were *approximately true*.
- But the ontologies were not approximately true. Is space approximately absolute? Does the ether approximately exist?
- What do you think about this response?

Structural Realism?

- Another response, by “structural realists” (e.g. James Ladyman) is that we should be realists only about the “mathematical structure” of our best theories, not their ontology.
- For, while the ontologies of the rejected theories has gone, much of their structure is at least approximately preserved in present theories.

Is that right? Are there cases where the structure has also been abandoned? Is anti-realism about the ontology of present theories giving up too much?

Present science is *better*?

- Sure, successful theories of the past were rejected.
- But *today's* successful theories are even more successful than those were.
- So we don't have good reason to expect that present theories will also be rejected.

Qu. How much of present science is more successful than Newtonian mechanics?

The Problem of Subjectivity

- Another argument for anti-realism is based on the need for subjective judgment, in addition to data, in theory choice.
- E.g. the Duhem problem, the need for judgments of 'prior plausibility' in IBE, the need for 'prior probabilities' in Bayes's theorem.
- Does this subjectivism undermine realism?

Argument for Realism

- The main argument for realism is the 'no miracles' argument, that the predictive success of science would be a 'miracle' if our theories were not (at least approximately) true.

9. Science and Authority

- Usually science can tolerate only a limited degree of dissent from the current orthodoxy.
- While different models can be proposed, they all fall within fairly tight limits imposed by the present paradigm.
- Theories based on alternative paradigms cannot get published in peer-reviewed journals.
- When a paradigm is in crisis, there is a lot more willingness to consider radical alternatives.

10. Categories

- 3 views about categories (realism, pragmatism, relativism)
- Natural kinds vs. arbitrary groupings
- Natural kinds are based on real divisions in the world, such as ancestral relationships in biology.
- A category of naturally-occurring objects may not be a natural kind.
- The role of natural kinds in laws, and inductive argument

11. Naturalism and Physicalism

- The history of naturalism and physicalism, especially ancient atomism and the 'mechanical philosophy'.
- The failure of the mechanical philosophy in 20th century physics (especially electromagnetism).
- Challenges to physicalism from the 'hard problem' of consciousness, accounting for objective rationality and other norms, the interpretation of quantum mechanics, and explaining the complexity of life.

- Methodological naturalism is different from naturalism.
- Should science assume naturalism, or should it be metaphysically neutral?
- Can non-natural explanations be supported by empirical evidence?
- Should MN be a rigid constraint on scientific theorising? (If so, then on what basis?)

12. Science and Religion

- There are different understandings of the relation between science and religion (conflict, interaction, independence)
- Historical understanding of the Galileo affair, and the history of evolutionary biology.
- Examples where religious ideas assisted, and hindered, scientific discoveries.