Week 13

Scientific change, scientific realism

Kitcher, Laudan

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Outline

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1 Darwin's innovation

Darwinian histories

- Kitcher begins with the following problem: every major claim in Darwin's theory, as presented in page 19, could have been endorsed by his opponents.
- Thus we have to understand where precisely the crucial disagreements lay.
- Preliminary answer: Darwin attached different theoretical significance to these claims.
- That is, he was able to see their explanatory power and to create novel explanatory techniques based on those claims.
- Kitcher suggests that we view Darwin's contribution in terms of articulating the explanatory links between the history of the given organism and its extant properties.
- As I understand it, Darwin was unique among his contemporaries to insist that these histories *alone* can provide the required explanations.
- That contrasts his approach with, e.g., de Candolle's and Forbes' (page 22).

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Example: analogy and homology in comparative anatomy

- Evolution of wings in different species (insects, birds etc.) represent an analogy.
- Wings evolved as a response to similar environmental pressures.
- By contrast, forelimbs in different mammals are explained as originating in the same organism.
- In both cases the crucial difference between Darwin and his contemporaries (Owen) is Darwin's appeal to a historical 'explanation'.

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Example: biogeography

- Question: why do we find so many marsupials in Australia?
- This is a quest for explanation, roughly in accordance with the pragmatic model of explanation.
- We have to fix the comparative class: why so few elsewhere outside Australia?
- Then we outline a Darwinian history.
- We show that marsupials reached Australia before the evolution of the placentals.
- We also claim that, elsewhere, the placentals were able to outsmart the marsupials and push them out.
- And that the placentals were not able to reach Australia (after the continental breakup).

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Darwinian histories

- We can reconstruct Darwin's explanations further by focussing on the notion of Darwinian histories.
- Begin with *minimal* Darwinian histories (pages 26–27).
- Here we do not pretend to identify the causes of evolutionary change.
- But this pattern may invite the objection that it merely 'lists' changes, without properly explaining them.
- Hence Darwin, on many occasions, turned more ambitious: evolutionary change was said to be caused by natural selection.
- That is, the occurring change allowed for a better reproductive success of its possessor.

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How Darwin changed biology

- The creation of a new *first* paradigm: before Darwin, there was no one acceptable way for biologists (as *we* would call them now) to practice their craft.
- Teleologists, for example, had little in common with practising naturalists.
- The language has changed: even though reference to theoretical entities (such as species) was preserved, ways of fixing this reference have changed.
- Similarly, Darwinism set new questions the biologists were supposed to ask.
- It set the criteria for acceptable answers.
- In all these regards it resembles scientific paradigms, as we saw in Kuhn.

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2 The realism debate

Reminder: Phenomenalism

- Many early empiricists believed that scientific theories could be translated into statements about observations.
- If this demand is taken globally, then such reductionist programme foundered already in 1928 when Carnap published *The Logical Structure of the World*.
- It turned out to be impossible to define the relation of similarity entirely in terms of elementary observations.
- Nagel provides another objection: it is impossible to correlate a theoretical statement about an electric current in the wire with particular observations.
- The class of these observations cannot clearly be demarcated.

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Scientific realism

- What is the debate about?
- Realism about entities: entities (states, processes) really exist.
- Anti-realism about entities: entities are our own constructs ('phenomena').
- Realism about theories: theories aim at truth and approach truth.
- Anti-realism (instrumentalism) about theories: theories are useful tools, taken literally or not.

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Ingredients of realism

- Ontology: entities exist.
- Causation: (unobservable) entities have causal powers affecting phenomena.
- Epistemology: we have a warranted belief in scientific theories.

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Meanings of 'real'

- So, it is natural to ask just what people mean by 'reality' or 'real'.
- 'Real' may be thought to be an ambiguous word.
- 'Real hero' may mean something totally different from 'real entity'.

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Materialism

- There is a definite number of bees in the hive.
- Or there is a definite number of electrons in a volume.
- But there is no definite number of lines in the magnetic field.
- So, some theoretical entitie are real, but fields are not real.
- But: there is a strong tradition in physics getting it the other way round.

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Causalism

- Real entities have causal effect on observable phenomena.
- But what is a cause?
- As we know, there must be a distinction between regularities and causal processes.
- A perfect regularity might not reflect a causal relation.

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Pragmatism

- Peirce's criterion: 'real' and 'true' mean whatever will be agreed upon at the end of the enquiry.
- There is no certainty attached to our claims in any particular case.
- But there will be a convergence of different opinions.
- Such a convergence cannot be achieved, for example, by indoctrination: such method will not be stable, as dissidents will emerge.
- Stability will be delivered by measurement.
- However: there is no guarantee that the convergence will happen in the long run.

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3 Arguments for anti-realism

A word on abduction

- Abductive inference, like deductive, consist on premisses and a conclusion.
- But the conclusion is not drawn by following a logical rule.
- Instead, the conclusion is supposed to explain better the evidence formulated among the premisses.

1. If the economy slows down, the inflation rate falls. (If P, then Q)
2. The inflation rate falls. (Q)
3. Probably, the economy slows down. (Probably, P)

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Convergent realism

Abduction I

1. If scientific theories are approximately true, they will typically be empirically successful.
2. If the central terms in scientific theories genuinely refer, those theories will generally be empirically successful.
3. Scientific theories are empirically successful.
4. (Probably) Theories are approximately true and their terms genuinely refer. (R1 and R2)

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Convergent realism (cont.)

Abduction II

1. If the earlier theories in a "mature" science are approximately true and if the central terms of those theories genuinely refer, then later more successful theories in the same science will preserve the earlier theories as limiting cases.
2. Scientists seek to preserve earlier theories as limiting cases and generally succeed.
3. (Probably) Earlier theories in a "mature" science are approximately true and genuinely referential. (R3)

Remark
Laudan in our selection debates *three* premisses: I.1, I.2, II.1. The premiss II.2 has already been discussed earlier in our course.

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Reference and success

- The question before us is: do the theories that genuinely refer are successful?
- Examples from history of science show that this is not the case.
- For many years theories that we currently believe to be referential have not been successful.
- These examples can be multiplied.

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The Downward Path

- (T1): 'If a theory is approximately true, then it is explanatorily successful.'
- Laudan complains that the notion of approximate truth is unavailable.
- This is rather weak: there are some accounts of approximate truth.
- More importantly, I think, we can apply the same arguments from the discussion of reference and success to show that approximate truth does not automatically yield success.
- This will block the abduction.

Atomism
Presumably ancient atomistic theories will judged approximately true. But for many centuries they failed to produce adequate explanations. In fact they were rejected in part because of that very failure. Objection: they were not approximately true. Reply: well, they were more so than their competitors.

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The Upward Path

- (T2): 'If a theory is explanatorily successful, then it is approximately true.'
- Here we appeal again to history of science to show that many theories than were thought to explain are (now) considered not at all approximately true.
- Examples can be easily found in Kuhn's monograph.
- Some of the more famous ones: phlogiston theory, the theory of electromagnetic aether.
- But many of these examples are problematic for Laudan's argument. [...]

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