Week 12

Scientific change

Kuhn

Slides for the lecture *Philosophy of Science* on 16 December 2014

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1 Kuhn's programme

Basic ambitions

- The notion of progress, if there is one, must be refined.
- History is key in understanding scientific change.
- Science is not always rational. Again, the notion of rationality must be refined.
- Scientific change is not determined by experiments, but experiments do still have a role.

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Kuhn's picture

1. Normal science dominated by the paradigm X.
2. Anomalies.
3. Crisis.
4. Revolution: paradigm Y replaces X.
5. Normal science dominated by the paradigm Y.

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Paradigm meanings

- It is an achievement accepted by a given community.
- It is likely to be codified in a classical book (*Physica*, *Almagest*, *Principia Mathematica*).
- It is unprecedented attracting many followers.
- It leaves sufficient space for further research: poses problems, rather than just solves them.
- It is a 'tradition of research'.

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Paradigm's pervasiveness

- It grants a researcher a place in the community.
- The researcher is unlikely to subsequently challenge the paradigm.
- The commitment is to the same rules and standards.
- A researcher works within a paradigm since the completion of his doctoral studies.

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Example: optics

- The current paradigm (wave-particle duality) is relatively young.
- Its predecessors are no longer mentioned in textbooks.
- No paradigm before optics became mature.
- Without a paradigm in place, research tended to go back to the basics.
- Shared rules and standards are a prerequisite for turning 'philosophy' into science.

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Paradigms and facts

- In the absence of a paradigm, the collection of facts is chaotic, since every fact seems as important as any other.
- Paradigm sets the rules of selection, evaluation, and criticism.
- (Another example: electricity.)
- Conclusion: the path to normal science is torturous.

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Increasing anomalies

- The 'insecurity' in the belief in a paradigm is created by the repeated failure of the normal science to resolve the puzzles 'adequately'.
- We have to explain 'inadequacy' further.
- The paradigm is never refuted.

Example 1 (Astronomy). Ptolemaic astronomy was as successful as Copernican astronomy in predicting the movement of stars, and almost as successful in predicting planetary movement. However: with the multiplication of epicycles the theory was getting more and more cumbersome.

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Conditions for the alternative

- Not the greater accuracy of the alternative.
- Not the greater simplicity.
- But the crisis and the long history of the anomalies.

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2 Response to the crisis

The response

- Not the abandonment of the old paradigm.
- But the creation of many adjustments and modifications.
- A puzzle at one time may become a counterinstance at another.
- The agreement of theory and fact is an illusion for two reasons: normal science engages in puzzle-solving, and, secondly, the science practitioners are unaware of alternative paradigms.

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Extraordinary science

- Magnifying anomalies.
- Giving structure to anomalies.
- Turning to philosophy

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Political revolutions

- A growing perception of malfunction.
- The conviction that political institutions must be changed.
- Individuals become *alienated* from the political system.
- The ineptitude of institutions leads to the failure of political resolution of conflicts.

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From politics to science

- Paradigms: incompatible modes of community life.
- The choice between paradigms cannot be made within normal science. (Why?)
- The circularity of arguments: does not make these arguments irrational.
- The role of persuasion.

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3 The necessity of revolutions

Intrinsic reasons of revolutionary development

- There is a logical possibility of cumulative development.
- New theories would exhibit aspects of the order of nature unnoticed before.
- But it is not found in actual practice.
- Further, there is a case to be made against possibility-in-principle.
- Men do not simply look around for solutions: they already have beliefs about where to look for solutions.
- Therefore, major discoveries are possible only through the destruction of old paradigms.

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Invention of new theories

- If phenomena are already well-explained by the paradigm, no reason exists for adopting an alternative.
- Other phenomena are 'puzzles' solved by normal science.
- Only anomalies call for the introduction of a new paradigm.
- But this new paradigm cannot be logically compatible with the old one: otherwise anomalies=puzzles.

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4 Incommensurability

Differences between paradigms

- Ontology: what exists. (Is this coherent though?)
- What science is: methods, standards, problem-field.
- Meanings of basic terms.

Example 2 (Method). Aristotelian explanations relied on 'essences'. But the new science demanded mechanical explanations. Essences became occult. And the same happened later to gravity.

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Changes of perspective

Kuhn's argument

1. Scientists never confront nature in its purity.
2. They have to use concepts and tools to formulate theoretical problems.
3. These problems suggest which evidence should be collected.
4. But concepts and tools are determined by the reigning paradigm.
5. Thus paradigms affect the way scientists 'perceive' reality.

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5 The mechanics of revolutions

Invisibility of revolutions

- Textbooks and philosophy of science deal with the victorious paradigm in the given discipline.
- They hide the historical development of the paradigm.
- (Digression: who is in charge of history generally? What are historical illusions?)

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Textbooks

- Use the standards, language, and problems of the dominant paradigm.
- Create a false sense of historicity.
- But show no real connection with history.
- There is less motivation to rely on history in science than in other disciplines: the dominant paradigm is secure at the time of normal science.

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Science and proress

- 'Does a field make progress because it is science, or is it a science because it makes progress?'
- Consider philosophy: there is a progress in its sub- and sub-sub-disciplines (say, Kantian ethics).
- But overall we say there is no progress in philosophy. Why?
- Because there are still competing schools of thought.
- There is no 'normal science' in philosophy.
- So, it is only within normal science that progress seems obvious.

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Normal science and progress

- Insulation from the wider community.
- No pressure to produce utility.
- Result: efficiency and effectiveness.
- Revolutions happen by appeal to authority within the community.
- But this authority is not an *arbitrary* one.
- Science growing in depth, but not in breadth.
- That is, progress does not bring us to truth.

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Homework 4

Discuss at least two reasons given by Kitcher for rejecting Laudan's defence of anti-realism.

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