

Philosophy of Science

Book notes from Ladyman

“Well you can argue all you like but I am going to carry on believing the scientists and not the people who tell me that the world will end and that I had better repent, and give them all my money. By induction, I know that they are very probably wrong, and the fact that I can’t convince”

Bacon

The problem with deductive arguments is that it cannot say more than is implicit in the premises.

- Bacon has this idea that we should do all we can to stop fooling ourselves. That we should be mindful of the idols of the mind, tribe etc.
- Experiment allows counterfactuals. Allows us to ‘torture nature for her secrets’.
- Bacon also advocates this search for the forms of natural phenomenon as opposed to the final cause, the ultimate cause.
 - Bacon explicitly urged that teleological reasoning be confined to the explanation of human affairs where it is legitimate since people are agents who act so as to bring about their goals.
- Finally, Bacon argues that when we’ve two rival equally explanatory theories we must devise a ‘pejorative instance’, an experiment to result in two outcomes based on what each theory might predict (‘crucial experiments’).

2. Induction

- Inductivism as Bacon uses it is generalising from a collection of instances to some conclusion.

Problem of Induction

- Hume makes the distinction between relations of ideas and matters of fact.
- Relations of ideas can be proven to be proved by deduction because its negation will imply a contradiction.
- If you can prove that its negation is inconsistent with other stuff you know.
- In my thinking, because matters of fact, or knowledge that is justified by sense perception is not a priori knowledge than we can’t prove it as true.

Apparently this is similar to what Kant talks about. Positivist developed this in the early 20th century to the notion that if what you say can't have implication for what we might observe in the future, then it's not knowledge.

- Hume claimed that all reasoning that goes beyond past and present is based on cause and effect.
- It is *causal relation* that connects ideas that have no logical relation. It is this relation that must be understood. There is no way to

We cannot tell that fire will burn us or that gunpowder will explode without trying it out because there is no contradiction in supposing that, for example, the next fire we test will not burn but freeze a hand placed in it.

- Importantly, belief in the relation of cause and effect is also based on believing the future will be the same as the past.

Cause and effect for Hume (via Ladyman)

- Events of type A precede events of type B in time.
- Events A are constantly conjoined in experience with events B.
- Event A lead to the expectation of event B.

Some would say there is a necessary connection between the two events rather than just this pattern that seems to hold. By Occams razor we would choose Hume's view.

Problems

It should be noted that various combinations of strategies 1, 5, 6, 7, 8 and 9 are the most popular in contemporary philosophy. Hence, someone might argue that Hume's argument shows us not that induction is irrational but that something is wrong with his reasoning (the sophisticated version of strategy 1), that what is wrong is that his account of our inductive practices is too crude (strategy 5), that our inductive practices really depend on inference to the best explanation where the explanations in question involve the existence of causal relations or laws of nature (strategies 6 and 7), and that inference to the best explanation cannot be justified in a completely non-question-begging way, but then no form of inference can (strategy 8). To this we might add that we only ever end up with a high degree of belief rather than certainty and that this is the best we can achieve and is, moreover, psychologically realistic (strategy 9).

- I think the question begging notion of induction (and deduction) is interesting. That you must accept them as your mode of reasoning to accept a proof of them. In some sense, maybe we do have to 'believe in science'.

- deductive inference is only defensible by appeal to deductive inference ... someone believes some proposition, p , and they also believe that if p is true then another proposition q follows, and so they infer q . What could they say to someone who refused to accept this form of inference? They might argue as follows; look, you believe p , and you believe if p then q , so you must believe q , because if p is true and if p then q is true then q must be true as well. They reply, 'OK, I believe p , and I believe if p then q , and I even believe that if p is true and if p then q is true then q must be true as well; however, I don't believe q '. What can we say now?
 - The probabilistic or notion of inference to best explanation also seems reasonable as a counter.
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- The chapter finishes with the idea that scientists, no matter what they say, haven't used induction in a lot of instances. Newton said that hypothesising is being merely speculative, but that's exactly what he did!
 - A major problem with Newton's account of his own discoveries was famously pointed out by the historian and philosopher of science Pierre Duhem (1861–1916), namely that Kepler's laws say that the planets move in perfect ellipses around the Sun, but because each planet exerts a gravitational force on all the others and the Sun itself, Newton's own law of gravitation predicts that the paths of the planets will never be perfect ellipses. So Newton can hardly have inferred his laws directly from Kepler's if the latter are actually inconsistent with the former
 - There's an interesting paragraph. And one thing that confused me is that I don't know if someone concerned with morality would necessarily say apriori they would not believe torture 'good' if they could not refute it somehow.
 - Given this, it is clear that, as in other areas of philosophy, we need to reach what is known as a 'reflective equilibrium' between our pre- philosophical beliefs and the results of philosophical inquiry. Consider the following analogy; in ethics we inquire into questions about the nature of the good and the general principles that will guide us in trying to resolve controversial moral issues, such as abortion and euthanasia. However, ethicists would reject any ethical theory that implied that the recreational torturing of human beings was morally acceptable, no matter how plausible the arguments for it seemed. In ethics we demand that accounts of the good do not conflict with our most fundamental moral beliefs, although we will allow them to force us to revise some of our less central moral views. So it is with the philosophy of science; accounts of the scientific method that entail that those scientists who

produced what we usually take to be the best among our scientific theories were proceeding in quite the wrong way will be rejected, but we will allow that an account of the scientific method can demand some revisions in scientific practice in certain areas. Indeed, it is permissible that we might conclude that most current science is being done very badly, or we might even conclude that most scientists are bad scientists; nonetheless, we ought not to conclude that our best science is bad science.

3. Falsification

- Popper was interested in why ideas like Marxism and Psychoanalysis wasn't real science. He said that they are too flexible. That they can confirm anything. They are too flexible.
- An example:
 - Various measures to increase safety for workers were introduced in England in the nineteenth century and this fact would seem to conflict with Marxism. Yet some Marxists have argued that, in fact, the introduction of the poor laws and so on confirm Marxism because they show that the capitalists were aware of the imminence of the proletarian revolution and were trying to placate the workers in order to stop or delay it.
- Popper argued that the 'confirmation' that a theory is supposed to get from observation of an instance that fits the theory, only really counts for anything when it is an instance that was a **risky prediction** by the theory; that is, if it is a potential falsifier of the theory.
- Popper says that the way to test a theory is to try and falsify it (find cases where it's false).
- Popper would support bold conjectures to explain things.
- Science proceeds something like natural selection according to Popper. There is no positive support for fittest theories rather there are just those that repeatedly survive attempts to falsify them.
- **It's the commitment to their theories that Popper finds unscientific about the likes of Marxism and Psychoanalytic.**
- Popper hated the idea of 'sacred' ideas. People can be adventurous in their theories. (Links to Hanson?)
 - Popper thought that theories could be ranked according to their degree of falsifiability and that this is the true measure of their empirical content. **The more falsifiable a theory is the better it is because if it is highly falsifiable it must make precise predictions about a large range of phenomena.** This seems to accord with an intuitive idea of what makes a

particular scientific theory a good one

The Duhem problem (well, what do we falsify in our theory Karl?)

- Light as a wave vs a particle, determining what part of the conjoined theory is at fault.
- There's never really a single hypothesis when we observe things. Rather it's conjoined with assumptions, like initial conditions and measurements reliability.
- $(T \& A) \vdash e$: T together with some set of assumptions entails e.
- $\neg e$: e is not the case (false).
- $\neg(T \& A)$: conjunction of T and assumptions is false.
- Where T is a premise denoting a hypothesis or theory. How do we know the assumptions have not been falsified?
- If you've a large number of observations with A under other scenarios (I know this is induction) but you've a reasonable accuracy. It doesn't really seem like a complete 'silver bullet' argument.

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- Popper allows room for the creative, intuitive notions of people to enter the scientific method. Not entirely focused on the rigor of 'observing cases' of things that inductivism would seem to prescribe.

Chapter 4 Revolutions

- This chapter is an overview of Kuhn.
- The way I understand, Kuhn mainly upsets the notion that science relies on observation alone and is free from human bias or influence of character.
- The received view of science before
- According to Ladyman, Kuhn's main notion is that of the *paradigm* that all observation takes place in this context.
- The example of Newtonian Physics is used. The way you see the world being influence by
 - Preference for causal explanations and testable predictions etc.
 - Metaphysical world being material, particles colliding with one another and the universe as a kind of clockwork machine.
 - Newtons laws then standard techniques of applying them.
- It all vibes with a more banal approach to day to day science. That this operation in a paradigm is not what causes leaps forward. Or though he hardly argues it contributes no progress at all?

- I got a sense in this chapter of how revolutionary Newton's thinking might have been. I mean the notion that the causes of a load of disparate things, like the tides, an apple from a tree etc. being due to the same source.
- Whereas Popper might view the progress of science as rational decisions between competing theories based on evidence Kuhn thinks it's a complete change in context from which questions are resolved. That evidence alone is never enough.
 - This brings in the notion of theory laden observation and what I referred to in my notes about Crusher in TNG solving the problem in that episode. Without knowledge or some paradigm that she is operating in, those observations make no sense. For instance, to us they'd make no sense. Expand on this...
 - One thing here is that Kuhn thinks scientists are content to account for anomalies in an otherwise successful theory. This doesn't seem to clash with Popper for me though (or as I understand the basic falsification notion) because it's still acknowledged that they are anomalies despite them not being fixed straight away.
 - The clash seems to be in the 'commitment' to theories. Popper has no time for it whereas Kuhn does or thinks it's part of it.
- Ladyman points out the rationality of believing the pre-existing theory before 'revolutions'. He uses the Ptolemaic paradigm as an example. Aristotle's account of nature fit with it, it certainly did not feel like we were moving, if we were rotating what of falling objects, should they not land somewhere else? p.106 all this seems perfectly intuitive. There were also anomalies initially in the Copernican theory. The idea that it was obvious and didn't require some element of savant's to take it up and/or crazy people to believe it and prove is something Kuhn is for.
- The notion of theory laden observation is still a debated issue. How much can we really dissociate from observation.
 - It's also the sense of how much social factors affect science.
 - * Kuhn's argues that there is no higher standard for comparing theories than the assent of the relevant community, and that '[the choice] between competing paradigms proves to be a choice between incompatible modes of community life' (Kuhn 1962: 94).