Week 5
Induction and confirmation
Russell, Popper, Goodman

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Outline

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1   The old riddle of induction

Hume on induction

[A]ll arguments from experience are founded on the similarity which we discover among natural objects, and by which we are induced to expect effects similar to those which we have found to follow from such objects. [I]t may surely be allowed a philosopher to have so much curiosity at least as to examine the principle of human nature, which gives this mighty authority to experience, and makes us draw advantage from that similarity which nature has placed among different objects. From causes which appear similar we expect similar effects. This is the sum of all our experimental conclusions. Now it seems evident that, if this conclusion were formed by reason, it would be as perfect at first, and upon one instance, as after ever so long a course of experience. But the case is far otherwise. Nothing so like as eggs; yet no one, on account of this appearing similarity, expects the same taste and relish in all of them. It is only after a long course of uniform experiments in any kind, that we attain a firm reliance and security with regard to a particular event. Now where is that process of reasoning which, from one instance, draws a conclusion, so different from that which it infers from a hundred instances that are nowise different from that single one? (EHU 4.20)

Hume's problem: Naive Response

- Let us give a paraphrase of Hume's classic argument.
- *Question*: Why to believe the statement 'The sun will rise tomorrow'?
- *Naive Response*: Because it has risen so many times in the past.

- This answer relies on the assumption that the past resembles the future.
- If in the past we had many tokens (instances) of the events of type A (sunrises in the east), then in the future A-events will also occur.
- This indeed *is* naive.
- The mere fact of many sunrises in the past does not much increase the confidence in their future occurrences (compare the chicken's belief in Russell's example).

Hume's problem: Sophisticated Response

- OK, let us try something more nuanced.
- *Sophisticated Response*: The sun will rise tomorrow, because the laws of motion in conjunction with certain actual conditions necessitate the rise of the sun in such and such conditions.
- Here we do not express any expectation of the occurrence of specific events.
- A meteorite can come out from nowhere and hit the earth, the planet itself may explode—all these catastrophes we readily allow.
- Therefore, in one sense, the future does *not* have to resemble the past.
- However, we insist that the laws of nature will hold in the future as they did in the past.

How the Sophisticated Response works

- Since we say that the laws of nature will hold in the future as they did in the past, we should be able to say that:

$$\text{If } A_1\text{-events occur, then } B_1\text{-events will occur}$$
$$\text{If } A_2\text{-events occur, then } B_2\text{-events will occur}$$
$$\dots$$
$$\text{If } A_n\text{-events occur, then } B_n\text{-events will occur.}$$

- Thus: if the earth stays its orbit and the sun is in its current condition and ..., then the sun will rise tomorrow.
- But if the meteorite hits the earth and ..., then the sun will not rise tomorrow.
- And, whatever happens, these events will be in accordance with the laws of motion.

Why the Sophisticated Response fails

- But it now seems that this enlightened reasoning contains the same less-than-enlightened assumption—namely, that the future should resemble the past.
- For the idea that the laws of nature hold forever and ever is based solely on the evidence that they held in the past.
- All these purportedly eternal uniformities have in fact held in the past.
- In the future a different set of uniformities can hold: for example, if A_1-events occur, then B_2-events will occur.

2 Russell's restatement

Russell's restatement and diagnosis

- We recognise the fact that people (and animals too!) form expectations about the future.
- But we query whether there are good (reasonable, justified) grounds for those expectations.
- Russell concedes that statements about future observations cannot be demonstratively (by which he may mean 'deductively') proven.
- But, he says, given a sufficient number of past observations confirming our law, we can be sure 'almost to certainty' that the law will hold in the future.
- We, therefore, have the 'principle of induction' consisting of two pars that he formulates in page 292.

- The principle of induction, according to Russell, cannot be refuted by experience.
- For we operate with probabilities, and probabilistic statements can never be *refuted*.
- Also crucially, the principle cannot be proven by experience.
- For *Russell accepts the scepticism about induction*.
- The purpose of the principle cannot, therefore, be in *justifying* our expectations of a future event.
- Rather, I think, its purpose is in *describing* how we form expectations about the future.
- As a matter of fact, Russell seems to say, we believe the principle of induction.
- He does not say that we are *right* to believe it.
- OK: we will now touch on some well-known attempted refutations of the classic argument.

3   Objections and replies

Objections and replies

Objection I
We have reliable hypotheses in science and daily life. Any sceptic about induction will go bankrupt (this is another reading of Russell's principle).

Reply
The objection misses the point. Hume asks whether we can *justify* statements about the future.

Objections and replies (cont.)

Objection II
Natural selection allows us to form correct expectations about the future. That is, we have a built-in cognitive mechanism for correct predictions.

Reply
This does not advance us by way of justification, since the claim itself utilises induction.

Objection III
Perhaps we have a pre-scientific *a priori* cognitive structure that allows us to draw inductive inference with *a priori* certainty (Kant).

Reply
This is a sly move, but how do we justify the existence of such a structure? Induction will penetrate this justification—unless we make metaphysical assumptions about the properties of human mind.

Objections and replies (cont.)

Objection IV (**Strawson**)
Let us use some conceptual analysis and argue as follows: It is a trivial truth that it is reasonable to have a degree of belief in a statement which is proportional to the strength of the evidence in its favour; and it is a trivial truth that, other things being equal, the evidence for a generalisation is strong in proportion as the number of favourable instances, and the variety of circumstances in which they have been found, is great. So to ask whether it is reasonable to place reliance on inductive procedures is like asking whether it is reasonable to proportion the degree of one's convictions to the strength of the evidence. Doing this is what 'being reasonable' simply means in such a context.

Strawson's objection explained

- The critic here does not advance any justification of induction.
- He rather professes to not be able to understand what kind of justification could be required for inductive procedures.
- Compare this to the question, 'Is the legal system of China legal?'
- We may very well ask whether a particular regulation is legal—i.e. whether it contradicts certain laws of the given legal system, say the Chinese one.
- But it is meaningless to ask whether the Chinese legal system as a whole is legal.
- (If you say that it may be illegal by the lights of the international law, you will implicitly render meaningless the question 'Is the system of international law legal?')
- By the same token, I may very well evaluate individual instances of inductive inference, but I cannot evaluate the inductive inference as a whole.

The analogy with law

- The analogy with law: it is instructive, though not in the way that Strawson intended it to be.
- For even though we cannot well ask whether International Law (or Chinese Law, or French Law) is legal, we can still ask whether it is 'acceptable'.
- We can ask whether it yields regulations and verdicts that to us appear unjust.
- If its implications are in this sense unacceptable, we are prepared to amend the system. If, on the other hand, we have a regulation or a verdict which contradicts a law we are unwilling to violate, then that regulation or verdict will be rejected.
- To think that a given legal system is not to be amended under any conditions is presumably to think of it as having some external standard of justification (e.g., a Divine command), or else to uphold a queer dogma as unconvincing, as it is repugnant.

Strawson's miss

Remark
Taking the law analogy one step further, consider also what kind of justification we can offer for deduction. If we do not want to postulate some self-evident truths, we once again will be engaged in the procedure of mutual adjustment of rules and inferences.

- So the right task is not justify induction as a whole—that is, e.g., not to ask why to believe the Uniformity principle—but rather to sort inferences into good and bad, acceptable and unacceptable.
- Now, what is the essence of Strawson's claim? Twofold: (1) Constant conjunction presents, by definition (being an analytic truth, as he says), good evidence for a generalisation. (2) This evidence not being fully conclusive, in any case affords us rational inferences about the unobserved.
- This last contention should be challenged.
- On its own, the bare fact of constant conjunction offers us no good evidence. Sometimes constant conjunction indicates accidental correlations, whereas on other occasions it indicates lawlike correlations.
- Only in the latter case it should be rational for us, even according to the critic, to draw inferences about the unobserved.

Transition to the new riddle of induction

Example 1. Every word I have spoken to you occurred before the last sentence of today's lecture. It would none the less be irrational for you to conclude that every word I will ever speak to you will occur before the last sentence of today's lecture. By contrast, every word I spoke to you was in English. Then it is rational for you to think that every word I will ever speak to you will be in English. (Indeed so: if I begin speaking to you in Hebrew, you will be at least mildly surprised.)

- Thus Strawson was right to point out that we should rank our beliefs based on evidence, and that there can be no justification of induction, especially if we mean by that some proof of the Uniformity principle based on an external assumption.
- But he appears to have missed the more important issue—that we must be able to tell good evidence from bad.
- Developing Hume's argument a bit, we can claim that this is impossible.
- Unless we are allowed the use of the Uniformity principle, all evidence is bad.

4   Popper's falsificationism

Science and pseudo-science

- Popper seeks to find a *demarcation principle* that would separate between science and pseudo-science.
- A traditional approach was to say that science is supported by empirical evidence and pseudo-science is not.
- But the problem of induction shows that scientific theories are not conclusively supported by evidence.
- On the other hand, those disciplines that we would like to classify as not scientific (Marxism, astrology, psychoanalysis) also seem to be based, at least in part, on evidence.

Demarcation principle

- The demarcation between science and pseudo-science is sought in the possibility of refutation.
- Scientific theories are sensitive to evidence in that they can be refuted on the basis of a piece of evidence.
- They are *falsifiable*.
- But pseudo-scientific theories cannot be refuted: every piece of evidence can be accommodated within them.
- Neither, however, are *verifiable*.
- A corollary of his account is that the problem of induction disappears as a problem in the philosophy of science.
- Another corollary is that a scientific activity is distinguished by the search for falsifications. By contrast, a pseudo-scientific activity is not at all interested in them.

5   Why the old riddle is not bad enough

Goodman on Hume

- In the first part of his discussion Goodman argues against some alleged misinterpretations of Hume's argument.
- We should not seek a global justification of induction.
- Any such justification would also employ induction (as already observed above).
- But that does not mean that induction should be arbitrary.
- Hume himself traced the confidence we have in induction to our 'habits'.
- And this may point in a right direction.
- Justification of induction must involve descriptions how induction takes place.
- That is: inductive practices can justify themselves.

Induction and deduction

- As Ramsey said, 'We are all convinced by inductive arguments, and our conviction is reasonable because the world is so constituted that inductive arguments lead on the whole to true opinions.'
- But is not there a vicious circle?
- Goodman's response is indirect.
- Let us consider deductive inferences where validity is (apparently) not doubted.
- We will then show that this very validity is *also* rooted in their practices (i.e. deductive practices).
- There is a system of rules and 'acceptable' inferences where each part is supposed to be tweaked to be brought into harmony with the other.
- So the old problem—how to justify valid inductive inferences—is dissolved by presenting the alleged analogy with deduction.
- But there is another problem: how to distinguish between good and bad inductive inferences.

6   Interlude on confirmation

H-D model of confirmation

- Goodman discusses Hempel's account of confirmation.
- Let us elaborate a little.
- Confirmation is a notion weaker than verification.
- A general law cannot be verified by a finite body of evidence, yet may well be confirmed by it.
- What is the relation between theories and the evidence confirming them?
- Perhaps it is the logical entailment in reverse, since some evidence-statements follow logically from the theory (recall the D-N model of explanation).
- Suppose then we have the following two rules:

Rules of confirmation
(1) Whatever confirms a given hypothesis H_1 would also confirm a stronger hypothesis H_2 (that is, when H_2 logically entails H_1). (2) Whatever confirms a given hypothesis confirms also a logical consequence of that hypothesis.

Nicod's criterion of confirmation

Paradox
Let H_1 be any hypothesis (say, Newton's Second Law). Let the observation report R consist of just the statement 'Jack is a raven'. Then R confirms the hypothesis H_2 (that Jack is a raven). But H_2 is entailed by $H_1 \& H_2$. So, R also confirms $H_1 \& H_2$. But H_1 is entailed by $H_1 \& H_2$. Therefore, R confirms H_2.

Nicod's criterion
In response to the paradox let us then impose the following constraint. Consider a hypothesis governing the behaviour of objects:

$$\forall x(Px \to Qx).$$

Then an object a confirms our hypothesis iff Pa and Qa; disconfirms it iff Pa and $\sim Qa$; is neutral iff $\sim Pa$.

Nicod's criterion is not a necessary condition

Equivalence condition
The following condition seems very plausible: whatever confirms (disconfirms) one of two equivalent sentences, also (confirms) disconfirms the other.

- Surprisingly, Nicod's criterion gets into trouble with the Equivalence condition.

- The existence of black ravens confirms:

$$\forall x (Rx \to Bx), \tag{1}$$

- But it does not confirm—as it should—the equivalent sentence:

$$\forall x (\sim Bx \to \sim Rx). \tag{2}$$

- Nicod's criterion cannot, therefore, be seen as a *necessary* condition of confirmation.

Nicod's criterion is not a sufficient condition

- So: an evidence statement that intuitively confirms a hypothesis might not confirm it according to Nicod's crietrion.
- Perhaps Nicod's criterion should be considered a *sufficient* condition of confirmation.
- That is, an evidence statement that confirms a hypothesis according to Nicod's criterion would always intuitively ('genuinely') confirm it.
- Alas, we are facing the notorious *paradox of the ravens*.
- Since non-black non-ravens confirm (2), they would also confirm (1).
- But clearly the existence of green frogs is irrelevant to the status of the hypothesis about ravens.
- Hence a paradox.

Exercise
Hempel himself appears to suggest that non-black non-ravens confirm (1) to a small degree. Is this a tenable view?

7 The new riddle of induction

Where we stand

- Even if a syntactic characterisation of laws should fail, one could still argue that a justification of induction is possible by inductive means.
- That is: we give up on proving validity of inductive inference in any acceptable way.
- But we maintain that such inferences should work where sufficient evidence has been accumulated.
- Inductive inference, while unjustifiable, are *reliable*.

Copper and electricity
Suppose that in one case 1000 samples of copper were examined and found to conduct electricity (R_1). Suppose that in another case 50 samples of copper were examined and found to conduct electricity (R_2). Then the body of evidence R_1 supports my belief—that the next sample of copper conducts electricity—to a greater extent than R_2. And that is all that matters.

The problem of lawlikeness

- Syntactic analysis alone does not provide us with the confirmation relation.
- While a piece of copper conducting electricity confirms the hypothesis that all pieces of copper conduct electricity, the fact that that piece of copper is owned by Barack Obama does not confirm the hypothesis that all pieces of copper in the world are owned by Obama.
- The difference between the two hypotheses is not in their logical relation with the respective pieces of evidence, but in that one is a lawlike generalisation, and the other is an accidental one.
- So we have to attend to the notions of lawlikeness and lawhood.
- And in doing that we are going to give up a positivist dream dispensing with necessity altogether (see our earlier discussion).

Grue!

- Now suppose we stick with intuitively lawlike predicates.
- Take, for instance, 'x is green'.
- Then even for this predicate there is a problem of using the available evidence to confirm a general law.
- To this end we devise a new predicate 'grue':

  x is grue $\leftrightarrow$ [(x is examined before t and x is green) or (x is not examined before t and x is blue)].

- Notice the difference:

  x is grue $\leftrightarrow$ [(x is green before t) and (x is blue after t)].

Question
How significant is the difference in the two formulations of 'grue'?

Bleen!

- So the problem is to distinguish the confirmability of 'green' from the confirmability of 'grue'.
- It may be thought that the problem is in the temporal (or other indexical) relativisation of the predicate.
- (That is, such a predicate will not be admissible into a scientific theory, since we will stipulate that any such theory would contain only purely qualitative predicates.)
- But consider:

  x is bleen $\leftrightarrow$ [(x is examined before t and x is blue) or (x is not examined before t and x is green)].

  x is green $\leftrightarrow$ [(x is examined before t and x is grue) or (x is not examined before t and x is bleen)].

- We are left with a new riddle of induction.
- Unlike Hume, we do not doubt that the future will resemble the past.
- But we are unable to say *in which way* it will resemble the past.