The Big Questions: Philosophy of Science Handout 1
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# The Problem of Induction

**Is science a rational enterprise?**
One of the aims of science, perhaps its most fundamental aim, is knowledge of laws of nature. So if we want to know if the scientific enterprise can be rational, we need to see if there is some method by which one can attain knowledge of laws of nature. (Then we can see if science *is* rational by asking whether it uses that method.)

**Laws of nature**
For now, think of a law of nature as being a general truth, e.g:

> All gases at the same temperature & pressure contain the same number of molecules per unit volume
> All metals expand when heated.
> All bodies fall with constant acceleration.

These all have the general form 'All Fs are Gs': they are *universal generalisations* (UGs for short).
This contrasts with singular statements like 'this piece of copper expanded when heated' or 'that stone fell with constant acceleration'.

**The big question:** Given that one only has singular statements to go on, how can one come to know the truth of a UG?

**A popular answer:** By "inductive inference", which takes the general form:

(*) This F is G
That F is G
:
:
Therefore

All Fs are Gs

In other words, we may *infer*, by inductive inference, that a general law ("all Fs are Gs") holds when we have observed a sufficient number of *instances* of the law ("this F is G", etc.).

*BUT . . . .*

David Hume, an 18th century Scottish philosopher, argued famously that we can have no knowledge of general laws. His argument can be reconstructed as follows:

**Hume's argument**

(1) Beliefs about general laws are attained by inductive inference
(2) Inductive inference is unjustified
(3) If a belief is unjustified, it does not count as knowledge.

Therefore

> We cannot have knowledge of general laws.

Each of Hume's premises seems intuitively plausible. But the conclusion is one which most scientists and philosophers do not like. If we can never know any general law, what's the point of doing science?

## Saving scientific knowledge: some responses to Hume's Argument

One kind of response to Hume's argument is to try and find a way of undermining premise 2, by showing that inductive inferences can be justified after all.

### Solution 1: A naive approach

Make sure your observed instances come from a wide enough variety of different conditions. (The inference to 'All swans are white' was bad inductive practice: nobody looked in Australia.)

First response: There's no *a priori* way of telling what counts as 'wide enough' or what counts as 'different conditions'. Do you need to make an observation in every country or just every continent? Do you need to vary the time of day or the clothes you wear when you run the experiment?

Second response: It's not just a matter of varying the conditions. Suppose you knew that all metals have expanded when heated up until now. 'All metals expand when heated' says more than this: it says they'll continue to do so in the future. But how can you know that they will? (You can't go to the future to find out!)

### Solution 2: Principle of Uniformity of Nature

To get around the second response, assert a principle of uniformity of nature, or as Popper puts it, of 'the immutability of natural processes': in effect, assert that the future will be like the past.

Response: What grounds are there for asserting such a principle? By inference from past success:

On all previous occasions the future has resembled the past
Therefore, the future will always resemble the past

But this argument has essentially the same form as (*): it employs the very inference we're currently trying to justify. Solution 2 is circular.

### Solution 3: Inductive justification of induction

Inductive inference was successful on occasion *x*
Inductive inference was successful on occasion *y*
Inductive inference is always successful

Response: Again, inductive inference is being used to justify inductive inference. In any case, the conclusion is manifestly false: remember 'All swans are white'.

**Solution 4: 'The retreat to probability'**

OK, inductive inferences don't *always* work, but they're *very likely* to lead to true conclusions.

Response 1: The new form of inference isn't really different to (*) - it still goes from the particular to the general. So the retreat doesn't help.

This F is G
That F is G
Therefore
Probably, all Fs are Gs

Response 2: UGs cover an infinite number of possible cases. So even if the above argument form were valid, reasoning from a finite number of observed cases would confer zero probability on the conclusion.

**Solution 5: Induction is rational by definition**

Anyone who understands the meaning of the term 'rational' will tell you that predicting future regularities on the basis of past observation is rational. So it is.

Response: This just avoids the original problem: sure, most people *think* induction's rational, but that's because they mistakenly think that there's some way of justifying it.

## Suggested reading

Call numbers beginning with B are to be found in the Chifley Library; Q call numbers are in the Hancock Library.


D. Hume — *Treatise of Human Nature* (B1485 1951/1978), Book I, Part III, *or: Enquiry concerning Human Understanding* (B1455.S4), section IV

P. Edwards & A. Pap (eds.): *A Modern Introduction to Philosophy* (BD21.E4), section on induction

A. Chalmers — *What Is This Thing Called Science?* (Q175.C446), chapters 1 & 2

J.S. Mill — *System of* Logic (B1603.S9), Book III, chs. I-IV and XXI (especially III & XXI) (reprinted in Edwards & Pap)

B. Russell — *Problems of Philosophy* (BD21.R8), chapter 6 (reprinted in Edwards & Pap)

A. O'Hear — *An Introduction to the Philosophy of Science* (Q175.O454), chs. 1 & 2

Also Bird's Book extract #2 (induction) on the readings page of the course website.