The Problem of Induction

By Nicholas Juckes

We use inductive arguments all the time. They are second nature to us. We extrapolate from our knowledge of the world (as we take it to be) and draw conclusions about what will very likely happen. They also form the basis of almost all science. But, it seems, there is a problem with them. Are we justified in our belief in them? And if we are not perhaps as justified as we think we are, does it matter? We will examine these questions.

What is an inductive argument? An inductive argument can be distinguished from a deductive argument as follows. A deductive argument (at least a valid one) is one in which the premises entail the conclusion: there is no possible way in which the premises can be true but the conclusion false. In this it is monotonic: it gives certainty because the conclusion cannot be changed by the addition of new information. All deductive arguments can be evaluated *a priori*, i.e. without reference to experience of the world. An inductive argument on the other hand makes use of *a posteriori* knowledge of the world and is one in which the premises give good ground for believing the conclusion but do not entail it. E.g.:

Premise: The sun has risen on every morning known to man.
Conclusion: The sun will rise tomorrow.

They are good to the extent that the truth of the premises makes the truth of the conclusion more likely. In this they are ampliative: their conclusions go beyond what is evident in their premises. But even in the strongest inductive argument it is possible that the conclusion is false. They are non-monotonic in that their strength can be changed by the addition of new premises. To some this is a weakness compared to deductive arguments but, as we shall see, that is at least controversial.

The sun has risen on a large number of occasions so we can be pretty confident it will rise tomorrow. But what about this:

Premise: Every hedgehog I have ever seen has been flat.
Conclusion: All hedgehogs are flat.

Obviously, I live by a road and I do not get out enough! If I did, I would observe many live, round hedgehogs. The sample size is crucial to the strength of the argument because an inductive argument is making an extrapolation from a sample to the general population and it is important that the sample is representative if I am to be justified in believing the conclusion.

The inductive argument above derives its strength from the conviction we have that, because something has happened a large number of times in the past (and has been observed in numerous places), it will therefore happen again in the same way tomorrow (and be observable in numerous places). No matter what scientific explanations we give or laws we quote, they all rely on what is termed the Principle of the Uniformity of Nature (PUN). Briefly: why will the laws apply tomorrow (or in a different place)? Answer: because they have always applied in the past. But there is no proof that this will happen only, a large expectation. In fact, one day the sun will not rise because it will have collapsed in on itself taking us with it (showing that the argument is non-monotonic!), but this does not detract from the fact that we rely on the PUN. Are we justified in this reliance?

David Hume (1) is famous for formulating the problem of induction: essentially we are not (completely) justified in inductive reasoning because we cannot justify the PUN. There is no logical contradiction in saying that the future will not be like the past. That is, we cannot utilise deductive reasoning to justify the PUN. It is logically possible that the laws of nature will be different when we wake up tomorrow, just like the turkey who expects his breakfast every morning until a catastrophic event just before Christmas! The fact that this seems at first outrageous to us is down to our strong affinity with inductive reasoning. But this

relies on the PUN. We cannot justify the PUN with inductive reasoning because this would be a circular argument. Circular arguments are valid but the conclusion is contained in the premises, so they do not further knowledge, and so they provide no epistemic support for justification.

Most scientific knowledge relies on inductive reasoning drawn from empirical *a posteriori* knowledge of the world. It is at the heart of scientific method. But it would appear that it is not rational to believe it (but not irrational). Karl Popper (2) believed that science is rational but not because it utilises inductive reasoning but because it centres on hypothesis and refutation. New scientific knowledge, he said, starts with a conjecture from which prediction is made which the theorist and peers attempt to disprove, usually by trying to find a counterexample. Only if it cannot be disproved, then the conjecture stands as knowledge. Note that this approach is not inductive and does not rely on the PUN. Knowledge is gained by deductive means in a falsification process. Popper felt that scientific theories were inferior to, say, mathematical proofs because they could never be proven (because of their reliance on deductive argument). All we can be sure of is that the theory has not been shown to be false (yet). New information can and often does change the theory as with the example of quantum mechanics modifying Newtonian physics. A problem with falsification is that it implies we do not have as much scientific knowledge as we thought we did! Theories are always in abeyance as far as proof is concerned. Also, what counts as falsification? A single counterexample observation could be explained away as spurious error or via another, exceptional theory.

If we have not overcome Hume's objection to induction is it rational then to rely on inductive knowledge? Reichenbach (3) was of the view that it is because if we do not then we can have very few true beliefs about the world. This is a pragmatic approach which we use all the time. In the absence of clinching argument we use the best knowledge we have especially *in extremis*, say when our life is at stake, clutching at unproven remedies. The rationality involved here is not justification for belief, more a good strategy for maximising outcomes on the lines of Pascal's wager. But one might argue that it is indirectly epistemically rational. Russell (4) points out that if we have neither knowledge nor error what we have is probable opinion. And, "a body of probable opinions, if they are mutually coherent, become more probable than any one of them would be individually".

Foster (5), has looked for justification of induction in terms of abduction, i.e. inference to the best explanation. Events in the physical world such as heavy objects falling to earth happen with monotonous regularity. The best explanation would be a law of nature (gravity) which necessitates this. Without the law the observed regularity, both in the past and with regard to future events, would be hard to comprehend let alone explain. The law of gravity is simply the best explanation of the phenomenon (for now). But many believe abduction is a concealed version of induction. It relies on the PUN and therefore may be subject to the same circularity. Others, e.g. Goodman (6), have tried to dissolve the problem of induction arguing that using inductive reasoning is rational because it accords with accepted argumentative practices: it is rational in the way that the law is legal.

So it appears that we lack grounds for our belief in the predictions of induction in the way that we do have for deduction. An epistemic externalist would say that this does not matter, just so long as beliefs obtained using it have been subject to an appropriate external process. And, that this process has been shown to result in reliable outcomes: the process is, in fact, reliable. The epistemic internalist needs appropriate supporting grounds and usefulness is not enough. He looks for these grounds in vain. Notwithstanding the internalist/externalist rationality debate, the value of inductively gained knowledge as useful can scarcely be doubted. For, as Russell (7) puts it: "…it is part of the business of philosophy to continue the consideration of such questions, to make us aware of their importance, to examine all the approaches to them, and to keep alive speculative interest in the universe which is apt to be killed by confining ourselves to definitely ascertainable knowledge".

End Notes/References

1 Hume D., *An Enquiry Concerning Human Understanding Part 1* (Clarendon 1902)

2 Popper K., http://en.wikipedia.org/wiki/File:Karl_ *Popper.jpg*

3 Reichenbach H., http://plato.stanford.edu

4 Russell B., *The Problems of Philosophy P81* (Oxford 1912)

5 Foster J., *Induction, Explanation and Natural Necessity* (Aristotelian Soc. 83)

6 Goodman N., *The New Riddle of Induction* (Indianapolis 1973)

7 ibid