Philosophy of science - 'The' problem of induction

Chosen question:

> (1) Fremstil induktionsproblemet i videnskabsteorien og redegør for de væsentligste reaktioner på problemet.

Introduction

I have chosen to write in english to reach a wider audience. I hope it will not lower the quality of the language in the essay too much.

The question does 'ask' about 'the' problem of induction in relation to philosophy of science, but it is not wise to ignore the 'roots' of 'the' problem, so I will have to write a bit about Hume on 'the' problem of induction. After Hume, I will discuss Popper and various probabilistic proposals to 'the' problem of induction. I will end the essay with my own view which is not similar to any of the others discussed as far as I know.

Readers my note my consistent use of apostrophes around the word “the” in “'the' problem of induction”. The reason for writing so is this: There is no single problem of induction but there is a wide variaty of problems called “the problem of induction”. Russell (as in Russell's theory of descriptions) would cringe if I simply wrote “the” (the definite article) knowing that there is in fact no single problem of induction. To see that I am right about this, one need simply read about the various solutions to 'the' problem of induction to see that they are not talking about the exact same problem. I would cite some examples if I had more space. Nonetheless, if one wants a general description of problems of induction, then something like “how to deal with various arguments against the rationality of inductive inferences” will likely suffice.

Hume on 'the' problem of induction

Even though Hume introduced 'the' problem of induction as we know it, he did not use the same terms as we use today, and a bit of interpretation is necessary to get an idea of what he meant. Basically, as Vickers (2010) notes, Hume does not use the terms “deductive” or “induction” but speaks instead of “demonstrative” and “probable” or “causal” reasoning which corresponds to our modern deductive and inductive reasoning.

Hume's argument is first found in Book I, Part III, section VI of the *Treatise.* A typical interpretation

of Hume's argument goes something like this (copied and expanded from Vickers (2010))

1. If the principle of the uniformity of nature is justified, then it is justified either by deductive reasoning or by inductive reasoning.

2. The principle of the uniformity of nature is not justified by deductive reasoning.

3. The principle of the uniformity of nature is not justified by inductive reasoning.

Thus, 4. The principle of the uniformity of nature is not justified.

The justification for (1) is plainly that all reasoning is either deductive or inductive. This will depend upon what one means with the word “inductive”. In older times, when people spoke of “induction” they just meant what is today called “enumerative induction”. Enumerative induction is inference of the form (or similar forms)

1. I have observed many times that things of the type A are also things of the type B.

Thus, 2. All A's are B's.

Today “inductive” means something like “not deductive” and so it would include abductive reasoning as well.

However, it is not really the case that the difference between deductive and inductive arguments is well-defined. I spent some time looking for works about this and none were to my satisfaction, but the details of this would take us too far away from the topic.

The justification for (2) is that all things justified by deductive reasoning (alone) are necessary truths, and the principle of the uniformity of nature is not a necessary truth, and thus, it is not justified by deductive reasoning.

The justification for (3) is that all inductive reasoning 'presupposes' or 'presumes' (obscure but insufficient space to clarify) the principle, and thus to attempt to justifiy the principle would be using the very same principle and thus be circular reasoning. The typical exposition ends here, but it really needs a last step before it works. The last step being that all circular reasoning is bad and gives no justification. We'll return to this later.

The inference (4) is plainly valid as the argument form is just denying the consequent with the consequent having the form of a disjunction, and the denial of the disjuncts being separete premises that is, (2) and (3).[I]

I In detail, denying the consequent (aka. modus tollens) is 1. $P \rightarrow Q$; 2. $\neg Q$; $\vdash$ 3. $\neg P$. The form of this argument is: 1. $P \rightarrow (Q \vee R)$; 2. $\neg Q$; 3. $\neg R$; $\vdash$ 4. $\neg P$.

Another thing worth mentioning in a footnote is that the argument is missing quantification about persons, because

Popper on 'the' problem of induction

Popper held the view that 'the' problem of induction is insoluble (so, he chose to 'bite the bullet' and accept the conclusion of Hume's argument). Popper thought that science 'does' (that is, scientists) not use induction (a descriptive claim) and that scientists should not use induction (normative claim). A good quote from Popper (found via Vickers (2010)) to illustrate his position is

> "[A] theory of induction is superfluous. It has no function in a logic of science.
>
> The best we can say of a hypothesis is that up to now it has been able to show its worth, and that it has been more successful than other hypotheses although, in principle, it can never be justified, verified, or even shown to be probable. This appraisal of the hypothesis relies solely upon deductive consequences (predictions) which may be drawn from the hypothesis: There is no need even to mention "induction"" (Popper 1935, 315).

"It has no function" is that descriptive or normative? Such unclarity of typical of Popper.

Thornton (2009) thinks that Popper thought that scientists do not use induction

> "Popper is unusual amongst contemporary philosophers in that he accepts the validity of the Humean critique of induction, and indeed, goes beyond it in arguing that induction is never actually used by the scientist.
>
> [...]
>
> Popper, then, repudiates induction, and rejects the view that it is the characteristic method of scientific investigation and inference, and substitutes *falsifiability* in its place."

Another good quote is found in the aptly named *Conjectures and Refutations*

> "Induction, i.e. inference based on many observations, is a myth. It is neither a psychological fact, nor a fact of ordinary life, nor one of scientific procedure." (Popper (1963) p. 53)

Popper's views has some dire consequences, especially for scientific reaslism (see Chakravartty (2011)). Basically, we are not justified in believing theories of science to be true or even justified, what we are allowed to believe, is that they have withstood all previous tests (or most or all good previous tests or something like that). The idea being that we ought to try not to prove theories but only try to disprove them (falsify them as in falsificationalism, Popper's views have a nice unity to them see Thornton (2009)). The form of inference for disproving theories from failed predictions is

justification is relative to persons. But this would needlessly complicate the argument so I left it out.

deductive and valid because it has the form (called “denying the consequent”)

1. If the theory is true, then we will observe O.

2. We did not observe O.

Thus, 3. The theory is not true.

while the form of proving theories by confirmed predictions is

1. If the theory is true, then we will observe O.

2. We did observe O.

Thus, 3. The theory is true.

which has an invalid argument form (called “affirming the consequent”). Given this, it is not surprising that he named his book about science “Conjectures and Refutations”, since the basic idea is that we make up some good or interesting guesses (conjectures) and then try to refute them.

Strangely, even though his views are not very easy to 'combine' with scientific realism, Popper was a staunch defender of scientific realism

> “[...] a dedicated opponent of all forms of scepticism, conventionalism, and relativism in science and in human affairs generally [...]“ (Thornton 2009)

Probabilistic proposals

There are lots of probabilistic proposals to deal with 'the' problem of induction, and they are often highly technical. These two facts make it very hard for me to summarize the works in just a half page or so which is what I have to do in this essay. I will try nonetheless but by focusing on a pair of researchers.

D.C. Williams and D.C. Stove

These two philosophers focus on proving that certain 'inductive' inferences are rational, because they have a high probability of being correct (and that this relation is a necessary truth). They tried to show that some inferences from the frequency of B's in a sample (a large one) of A's to the frequency of B's in the entire population of A's. In Williams' words

> “1. The relative frequency of the trait R in the sufficiently large sample S from the finite population X is r. f(R | S) = r

therefore

2. The relative frequency of R in X is close to r. f(R | X) ≈ r" (Williams (1947), p. 12; Stove (1986), p. 71–75, as quoted in Vickers (2010))

The claim being that the inference from (1) to (2) is highly likely and that this relation is a necessary truth.

Over the years a lot of problems and alleged problems were found with this proposal and similar ones but I am not sufficiently skilled in probability theory to judge this discussion and there is insufficient space to try.

My view

The Hume's argument against ~~induction~~ deduction

An argument analogous to Hume's argument exists (or can be made, depending upon your favorite theory of truth carriers) for deductive reasoning

1. If we are justified in using deductive reasoning, then the reason why we are so is deductive or inductive.

2. The reason is not deductive.

3. The reason is not inductive.

Thus, 4. We are not justified in using deductive reasoning.

I suppose a typical skeptic might accept this argument, but that's not what I want to do with it. My point is that it *seems* to be the case that deduction is no more justified than is induction, and so that if there is a problem with induction, then there is also a problem with deduction.

However, before we get ahead of ourselves, we might want to make sure that the argument is sound (it is of course valid). I think that it is not. Specifically, premise (3) is false. Why? Because one *can* use induction to justify deduction. To take a really simple example (using enumerative induction). Suppose that one has observed some thousand arguments with the form affirming the antecedent[II], and one has never found a such argument with true premises and a false conclusion. One then infers, that there is no such argument of the form affirming the antecedent. Similarly, one can do so with other simple deductively valid argument forms and establish their validity. Then, one can justify other more complex argument forms using the simple argument forms. If one did this and

II Aka. modus ponens. It is the argument form: 1. P→Q; 2. P; ⊢3. Q.

induction is rational/justified/reasonable (or whatever), then deduction is also fine.

So, if the philosophers wanted to move along with their project of establishing the rationality of some kind of reasoning, then they should start with justifying deduction, not induction.

The real problem™

I hinted at it earlier, but I think that there is something wrong with the typical approaches to 'the' problem of induction. The something which is wrong, is that a foundationalist theory of justification is assumed or at least, it is assumed that circular reasoning is always bad (that is, never gives justification). Unfortunately, I have insufficient space to explain to views in further detail but I may direct the reader towards writings about coherentist theories of justification. I very much like Quine (1978) but see also Kvanvig (2008) and Murphy (2011).

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