HPSC 1001/1901/2101/2901

WHAT IS THIS THING CALLED SCIENCE?

Semester 2, 2020

Lecture 18: Science and Values

* *Reading:* Lots is indirectly relevant, but nothing in the textbook about this. Some new ideas. See also the Rudner paper on Canvas.

A standard way of setting up a question: should science be value-free?

How the debate is often described.

On one side: Yes. A crucial part of the intellectual style developed in the Sci Rev is the dispassionate and disinterested study of nature –being guided by facts and without prejudices.

Longino on traditional conception of objectivity (from last time): objectivity involves an absence of bias and "subjective" influences.

Values of the researcher -- these are subjective.

Ideas earlier in the course related to this picture:
A 'logic' of confirmation (Logical Empiricism).
Popper on open-mindedness and embrace of criticism of all ideas.
Avoidance of dogmatic attitude to your views.

Whatever might interfere with this is to be resisted, as far as possible.

Then:

Other side: All this is impossible.
Messages of Kuhn, etc. sociology of science. It's not a way things could be, whether desirable or not.
No logic of confirmation exists that could guide scientists.
There is some degree of "theory-ladenness of observation."
Importance of internal dynamic of scientific communities, and (according to sociology of science) broader political and social interests and affiliations of scientists.

Intrusion of values is inevitable.
Given that, what should be our attitude?

Accept the situation – accept the 'impurity' of scientific choices in this respect – and do a better job with it?
Allow integration of scientific decision-making with broader priorities and values, and do so with eyes open.

Support from scientific practice: A collection of policies that can be seen as accepting a role for values of some kind. These tend to involve some sort of "benefit of the doubt." There will always be doubt about which theories are true (fallibilism). Some views deserve the benefit of the doubt over others.

1. "Null hypotheses": These have to be shown false (or probably false) in order to establish an alternative. If the evidence is

equally compatible with the null and the alternative, the null gets the benefit of the doubt.

H_0 (null): the new drug is no more effective than the old drug.
H_1 (alternative): the new drug is more effective than the old drug.

"Significance levels" in statistics make this benefit of the doubt more precise.

2. "Precautionary principle" (in some versions). You do not need to be *certain* that a pesticide (for example) will cause harm before concluding that it is not safe.

For example: "Rio Declaration" of 1992 UN Earth Summit:

> In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_CONF.151_26_Vol.I_Declaration.pdf

R. Rudner 1953, "The scientist qua scientist makes value judgments."

> [S]ince no scientific hypothesis is ever completely verified, in accepting a hypothesis the scientist must make the decision that the evidence is *sufficiently* strong or that the probability is *suffciently* high to warrant the acceptance of the hypothesis. Obviously our decision regarding the evidence and respecting how strong is "strong enough", is going to be a function of the *importance*, in the typically ethical sense, of making a mistake in accepting or rejecting the hypothesis. Thus, to take a crude but easily managable example, if the hypothesis under consideration were to the effect that a toxic ingredient of a drug was not present in lethal quantity, we would require a relatively high degree of confirmation or confidence before

accepting the hypothesis – for the consequences of making a mistake here are exceedingly grave by our moral standards. On the other hand, if say, our hypothesis stated that, on the basis of a sample, a certain lot of machine stamped belt buckles was not defective, the degree of confidence we should require would be relatively not so high. *How sure we need to be before we accept a hypothesis will depend on how serious a mistake would be.*

The examples I have chosen are from scientific inferences in industrial quality control. But the point is clearly quite general in application.

So perhaps we should accept the mixing of values with evidence in science? This can be seen as compatible with a "web of belief" view (Quine).

I think: the discussion is being set up in a bad way.
Start again.

1. Science is a human activity. All human activities are guided by values of *some* sort. It might be a desire to understand, a desire to resolve questions about how the world works. That is not "value free." It is a particular kind of value.

Distinguish: *epistemic* values (knowledge, understanding) from *non-epistemic* values (money, health).

2. What do we choose to investigate? We can't understand everything, and there would be no point in understanding some things even if we could.

Here practical goals and values become relevant. Climate change, obesity... We value answering some questions more than others.

3. Benefit of the doubt, etc? More critical response to this.

Rudner again:

> [S]ince no scientific hypothesis is ever completely verified, in accepting a hypothesis the scientist must make the decision that the evidence is *sufficiently* strong or that the probability is *suffciently* high to warrant the acceptance of the hypothesis.... *How sure we need to be before we accept a hypothesis will depend on how serious a mistake would be.*

A closer look at these claims.

"Acceptance" of a hypothesis. Treating it as true, or probably true.

Rudner's picture: the evidence pushes a certain distance, and then you have to decide whether to *accept* something. This is like a

(small) leap, an extra move. It goes beyond noting where the evidence pushes.

How do we decide whether to accept something? The evidence has already done all it can do. What is left is the practical side: "*How sure we need to be before we accept a hypothesis will depend on how serious a mistake would be."*

The appearence of a problem about the appropriate role played by the practical values comes from the on-or-off treatment of belief (or acceptance). There is a "gap" that has to be bridged.

Alternative view: Start with the idea of degrees of belief. Imagine belief on a scale, from 0 to 1.
(Or 0% to 100%.)
You are fairly sure, very sure, completely sure....
A *graded* notion of belief.

If you work within this view, then it's still possible to allow an extra influence for the practical side, non-epistemic values, but it becomes unnecessary, and looks like a bad idea.

Unnecessary: there is no extra move to make to get you to "acceptance." The evidence just pushes you to a certain degree of confidence or degree of belief.

And then you work out what to *do* – a separate matter.

* This depends on the assumption that evidence itself *can* push you to a degree of belief. We need a new theory of confirmation, based on the idea of degree of belief. Next week for this.

Bad idea: You are going to use your beliefs about the world in many behavioral decisions, not just one. Why does this matter?

Example: Suppose you are working out whether to take an umbrella when you leave home. You are not sure whether it will rain or not.

One model: work out whether to *accept* that it will rain. Then act accordingly. It's assumed that there is some natural course of action that will follow from your acceptance, and the value of this course of action (relative to alternatives) is what helps determine whether you accept that it will rain.

Another model: work out *how confident you are* that it will rain. Suppose your confidence is 70%. This is not a measure of a physical probability of rain; it is just your own degree of belief, a measure of your confidence.
Your degree of belief that it will *not* rain is then 30%.

You have two behavioral options: take an umbrella *versus* don't take one. Each combination of weather plus behavior gives some *payoff*.

Rain, umbrella: (OK)
Rain, no umbrella: (quite bad)
No rain, umbrella: (A bit annoying)
No rain, no umbrella: (OK)

You can put all these together to tell you whether it makes sense, given you degrees of belief and your values, to bring an umbrella.

Expected payoff from bringing umbrella =
DB(Rain)*V(Rain and umbrella)
+ DB(No rain)*V(No rain and umbrella).

Expected payoff from not bringing umbrella =
DB(Rain)*V(Rain and no umbrella)
+ DB(No rain)*V(No rain and no umbrella).

Here, "DB(Rain)" is your own degree of belief that it will rain.
V(...) is the value to you of some combination.
Which expected payoff is higher?

What we have done here is keep the degree of belief side *separate* from the side concerned with the payoffs of different

behaviors, until the final move where we put them all together. In working out your degree of belief that it will rain, you *don't* allow the choices about umbrellas to play a role. That comes later.

Stage 1: work out your degrees of belief. What do you think is likely to be true?
Stage 2: work out what do do, given your degrees of belief and your evaluation of various possible outcomes of behaviors.

Above: You are going to use your beliefs about the world in many behavioral decisions, not just one. Your degree of belief in rain will affect your decision whether to carry an umbrella, whether to water the garden, whether to go bushwalking....

All of these need to be handled separately. It's not a good idea to allow *one* of them (or a couple) to affect your belief about rain – the next decision you face might be very different in the costs and benefits that apply.

* These ideas (or very close) were part of a reply to Rudner's 1953 article by Richard Jeffrey, "Valuation and Acceptance of Sscientific Hypotheses," *Philosophy of Science,* 1956.

A return to those ideas about "null hypotheses":

H_0: the new drug is no more effective than the old drug.
H_1: the new drug is more effective than the old drug.

First work out what the evidence suggests, *then* work out how to handle the behavioral decisions that come afterwards (do we allow the drug to be prescibed? Do we keep working on it? All those decisions are made on the basis of the evidence *and* various evalulations we have of outcomes of our actions. H_0 does not get the benefit of the doubt. (Here I am being unorthodox -- some statisticians and scientists will disagree.)

First work out what the evidence suggests, *then* work out how to handle all sorts of behavioral decisions that come afterwards. That applies also to "precautionary principle" cases.

Behavioral decisions include: whether to do more research, whether to do one survey or another survey or no survey, whether to teach a theory in schools. Those are all practical matters, affected by non-epistemic values. So is the decision about what you might *say*. This is a practical question affected by costs and benefits, too.

I think a lot of science and values questions will look different once we have a model like the 2-stage one above. But this does depend on making sense of the idea that evidence can guide your degree of belief. Is this really possible? Will come back to this....