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# Why Good Science Is Not Value-Free

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society in science
The Branco Weiss Fellowship

# Outline

I. Some Terminological Preliminaries

II. The Argument from Inductive Risk

III. Consequences of the Argument

# I. Some Terminological Preliminaries

## The Value-Free Ideal of Science

- The goal of science **is to produce robust, objective knowledge** about empirical reality.
- **The results of science** should not be influenced by social or moral values.
- Scientists **must not** engage in political, ethical or moral debates, in order not to compromise their independence and credibility.
- **Example**: Scientists provide facts and evidence for or against man-made global warming. They do not directly engage in policy-making.
- **Consequence**: Division of labor between scientists and decision-makers.

# I. Some Terminological Preliminaries

## Normative vs. Descriptive Statements

There are 258 people in this room. The room has 2 emergency exits.

It is not safe to put more than 250 people in a room with only 2 emergency exits.

**The justification of normative statements involves the consideration of values!**

# I. Some Terminological Preliminaries

## Two Basic Modes of Inference

**DEDUCTIVE**

All humans are mortal

Socrates is a human

---

Socrates is mortal

RISKY!

**INDUCTIVE**

Observation Data

Socrates is a swan.

Evidence

Socrates is white

---

Hypothesis, Model, Theory

All swans are white

**Many inferences in empirical science are inductive!**
**They are affected by inductive risk.**

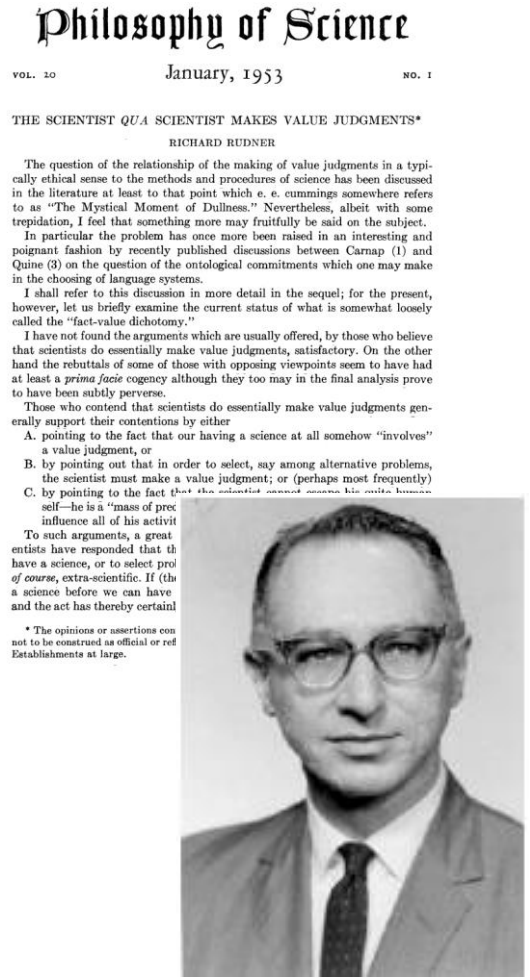
# II. The Argument from Inductive Risk

## Richard Rudner's *The Scientist Qua Scientist Makes Value Judgments* (1953)

"Now I take it that no analysis of what constitutes the method of science would be satisfactory unless it comprised some assertion to the effect that the scientist as scientist accepts or rejects hypotheses.

But if this is so then clearly the scientist as scientist does make value judgments. For, since 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 *sufficiently* 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.

[...] *How sure we need to be before we accept a hypothesis will depend on how serious a mistake would be.*"



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THE SCIENTIST *QUA* SCIENTIST MAKES VALUE JUDGMENTS*

RICHARD RUDNER

The question of the relationship of the making of value judgments in a typically ethical sense to the methods and procedures of science has been discussed in the literature at least to that point which e. e. cummings somewhere refers to as "The Mystical Moment of Dullness." Nevertheless, albeit with some trepidation, I feel that something more may fruitfully be said on the subject.

In particular the problem has once more been raised in an interesting and poignant fashion by recently published discussions between Carnap (1) and Quine (3) on the question of the ontological commitments which one may make in the choosing of language systems.

I shall refer to this discussion in more detail in the sequel; for the present, however, let us briefly examine the current status of what is somewhat loosely called the "fact-value dichotomy."

I have not found the arguments which are usually offered, by those who believe that scientists do essentially make value judgments, satisfactory. On the other hand the rebuttals of some of those with opposing viewpoints seem to have had at least a *prima facie* cogency although they too may in the final analysis prove to have been subtly perverse.

Those who contend that scientists do essentially make value judgments generally support their contentions by either

A. pointing to the fact that our having a science at all somehow "involves" a value judgment, or

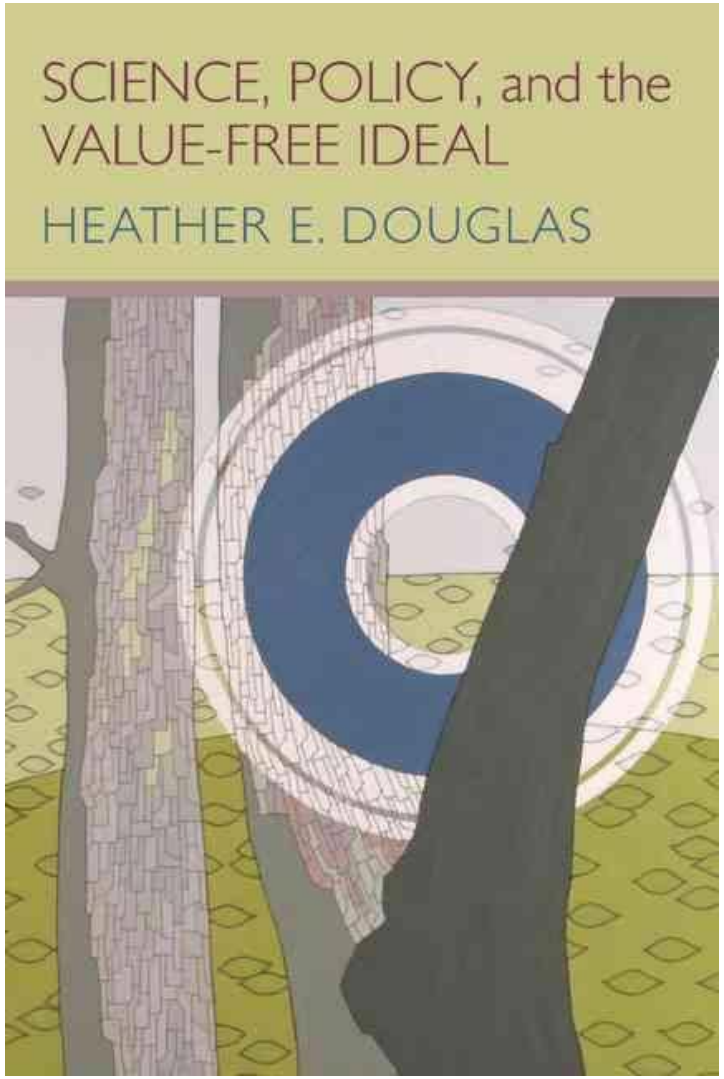
B. by pointing out that in order to select, say among alternative problems, the scientist must make a value judgment; or (perhaps most frequently)

C. by pointing to the fact that the scientist cannot escape his quite human self—he is a "mass of prec
influence all of his activit

To such arguments, a great
entists have responded that th
have a science, or to select pro
*of course*, extra-scientific. If (th
a science before we can have
and the act has thereby certainl

* The opinions or assertions con
not to be construed as official or ref
Establishments at large.

# II. The Argument from Inductive Risk



# II. The Argument from Inductive Risk

## Summary of the Argument

- Scientists **accept/reject hypotheses** based on evidence.
- Acceptance/rejection of hypotheses involves a **decision** as to when the evidence is strong enough (inductive risk).
- Such a decision involves the consideration of **consequences of potential errors**.
- If inductive errors can lead to serious foreseeable consequences (e.g. in toxicology), the acceptance/rejection of hypotheses must include normative considerations. **Scientists *qua* scientists must make value judgements!**

# III. Consequences of the Argument

## Characterization of Evidence

TABLE 1 FEMALE SPRAGUE-DAWLEY RAT LIVER SLIDE EVALUATIONS
(Adapted from EPA 1994, p. 6–5)
Key: B = Rats with Benign Tumors
M = Rats with Malignant Tumors
T = Total Rats with Tumors

| Dose Level | | 1978 | 1980 | 1990 | Acute Toxicity in Rats |
|---|---|---|---|---|---|
| 0 ng/kg/day (control) | B | 8/86 | | 2/86 | no acute liver toxicity observed |
| | M | 1/86 | | 0/86 | no acute animal toxicity |
| | T | 9/86 | 16/86 | 2/86 | |
| 1 ng/kg/day | B | | | | liver toxicity observed |
| | M | 0/50 | | 0/50 | no acute animal toxicity |
| | T | | | | |
| 10 ng/kg/day | B | 18/50 | | | livers with tumors show some |
| | M | 2/50 | | 0/50 | acute toxicity |
| | T | 20/50 | 27/50 | 9/50 | debatable acute animal toxicity |
| | | p<0.001 | p<0.001 | p<0.01 | |
| 100 ng/kg/day | B | 23/50 | | 14/50 | 18/18 livers with tumors show some |
| | M | 11/50 | | 4/50 | acute toxicity |
| | T | 34/50 | 33/47 | 18/50 | clear acute animal toxicity |
| | | p<0.001 | p<0.001 | p<0.001 | |

**Data does not speak for itself!**
**It needs to be interpreted. Interpretation of data involves judgment.**

See Douglas (2000), pp. 569-572

# III. Consequences of the Argument

## Interpretation of Results

- Threshold vs. no threshold?
- This is not an empirical question!
- It is a matter of interpretation, statistical power etc.

**The interpretation of empirical results can change depending on background assumptions. Choosing background assumptions is not value-free.**

See Douglas (2000), pp. 573- 576

# III. Consequences of the Argument

## Normative Conclusions

- The value-free ideal of science has to be rejected. Scientists qua scientists must make value judgments.
- Scientists should make their values explicit!
- Scientific objectivity need not preclude value judgments.
- Scientists are morally responsible for foreseeable harmful consequences of potential errors.

**Good science is not value-free!**

# Why Good Science Is Not Value-Free

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## Thank you for your attention!