The Origins of the Argument from Inductive Risk

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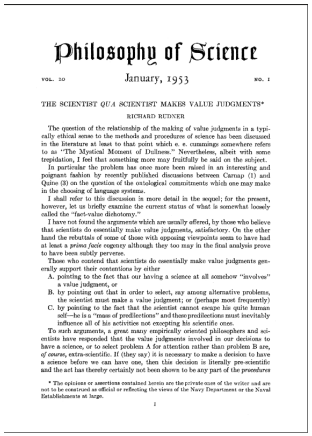
Rudner's argument from inductive risk



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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 (2) 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—be it "mass of predilections" and those predilections must inevitably influence all of his activities not excepting his scientific ones.

To such arguments, a great many empirically oriented philosophers and scientists have responded that the value judgments involved in our decisions to have a science, or to select problem A for attention rather than problem B are, *of course*, extra-scientific. If (they say) it is necessary to make a decision to have a science before we can have one, then this decision is literally pre-scientific and the act has thereby certainly not been shown to be any part of the *procedures*

* The opinions or assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval Establishments at large.

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Rudner's argument from inductive risk:

(P1) Scientists qua scientists must accept and reject hypotheses.

(P2) Accepting and rejecting hypotheses requires choosing a threshold.

(P3) Choosing a threshold requires weighing different errors.

(P4) Weighing different errors requires making value judgments.

$\therefore$ (C) Scientists qua scientists must make value judgments.

Plan for the talk

1. History: Rudner gets the argument from statistics – ultimately from Jerzy Neyman and Egon Pearson.
2. Context: Rudner probably viewed statistics as *progressing* towards a "scientific" treatment of values.
3. Upshot: Rudner's argument should be viewed as having two importantly different components.

The origins of the argument

Rudner's sources

"the foregoing arguments, the substance of which has, in one form or another, been alluded to in past years by a number of inquirers (notably C. W. Churchman, R. L. Ackoff, and A. Wald)"

- Rudner (1953, 4)

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Papers in *Philosophy of Science*: Churchman (1948), Churchman and Ackhoff (1947).

Rudner was Churchman's student at Penn in the late 1940s.

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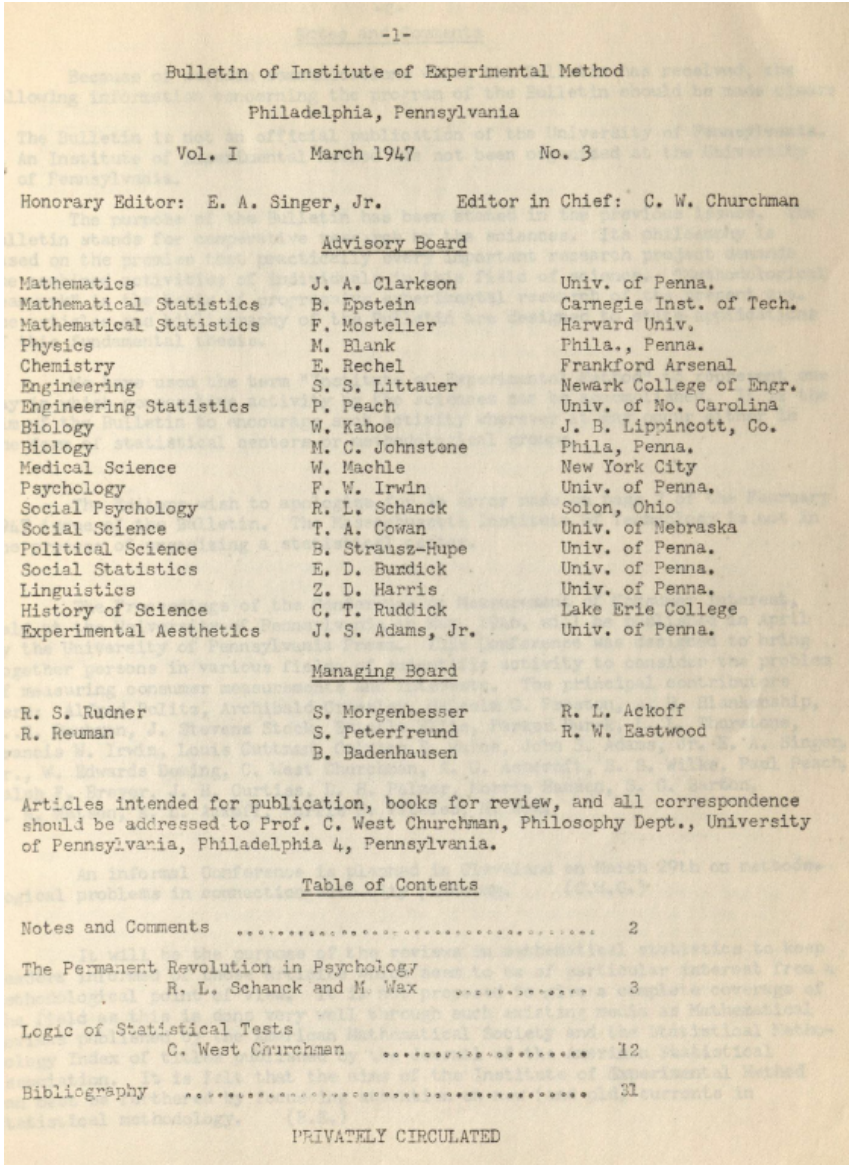

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"Logic of Statistical Tests" by C. West Churchman

"Logic of Statistical Tests"

"As Wald [(Wald 1942)] shows, the [choice of method of selection] depends upon a "weight function" which measures the "loss" entailed in accepting an alternative H_i when H_j is true. The weight function is "non-statistical" in the sense that its form cannot be derived within a statistical system."

- Churchman (1947, 20)

"Logic of Statistical Tests"

"As Wald [(Wald 1942)] shows, the [choice of method of selection] depends upon a "weight function" which measures the "loss" entailed in accepting an alternative H_i when H_j is true. The weight function is "non-statistical" in the sense that its form cannot be derived within a statistical system."

- Churchman (1947, 20)

Credits the statistician Abraham Wald (here and elsewhere) with the central insight.

(Only modern references to Wald I've found: Staley (2017), Wilholt (2009).)

Abraham Wald

"The choice of [statistical decision function] will essentially be affected by the relative importance of the different possible errors we may commit. ... We introduce a weight function for the possible errors. ... The question as to how the form of the weight function should be chosen is not a mathematical nor statistical one. The statistician who wants to test certain hypotheses must first determine the relative importance of all possible errors end this will depend on the special purposes of his investigation."

- Wald (1942, 40–41)

A very similar formulation appears in Wald (1939, 301–2). In Wald (1942), he presents himself as generalizing both Fisher and Neyman and Pearson. No citation to Fisher appears in the Wald (1939).

Neyman and Pearson

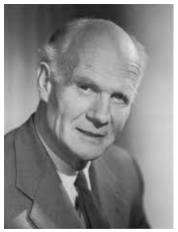
"If we reject H_0, we may reject it when is true; if we accept H_0, we may be accepting it when it is false, that is to say, when really some alternative H_t, is true. These two sources of error can rarely be eliminated completely; in some cases it will be more important to avoid the first, in others the second. ... Is it more serious to convict an innocent man or to acquit a guilty? That will depend upon the consequences of the error; is the punishment death or fine; what is the danger to the community of released criminals; what are the current ethical views on punishment? From the point of view of mathematical theory all that we can do is to show how the risk of the errors may be controlled and minimized. The use of these statistical tools in any given case, in determining just how the balance should be struck, must be left to the investigator."

- Neyman and Pearson (1933, 296)

Origins of the argument from inductive risk

Neyman

Pearson



(1933)

Wald

(1939, 1942)

Churchman

(1947, 1948)

& Ackhoff

(1947)

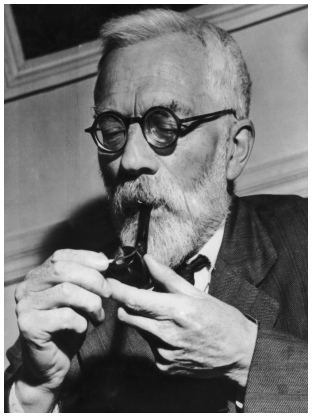
Rudner

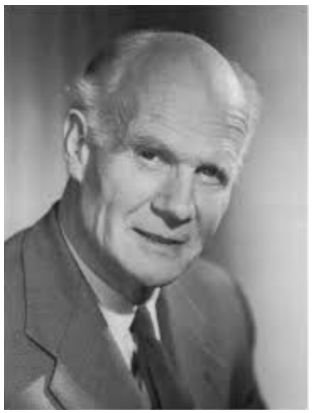
(1953)

The statistical context

The Fisher-NP disagreement (roughly 1935-62)

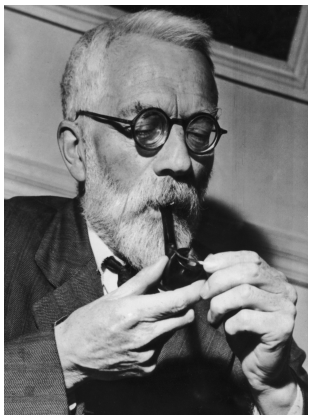
Statistics is concerned with evidence. Decisions and their costs are **not** part of statistics or the responsibility of the statistician.





Statistics is concerned with behavior. Decisions and their costs are part of statistics and the responsibility of the statistician.

Fisher *contra* Rudner



"It is important the scientific worker introduces no cost functions for faulty decisions, as it is reasonable and often necessary to do with an Acceptance Procedure. To do so would imply that the purposes of which new knowledge was to be put were known and capable of evaluation."

- Fisher (1959, 103)

Odd bedfellows: Fisher and Jeffrey

"Pairing arbitrarily, or at random, will certainly supply a 'decision,' as, indeed will tossing a coin without reference to the data, but such methods ignore the statistician's obligation to summarise adequately the weight of evidence actually supplied by the data, against any theoretical view, and to do this is the only valid purpose of tests of significance."

- Fisher (1958, 128)

(This passage appears for the first time in the 13th edition of *Statistical Methods for Research Workers*; Fisher wrote it after 1954.)

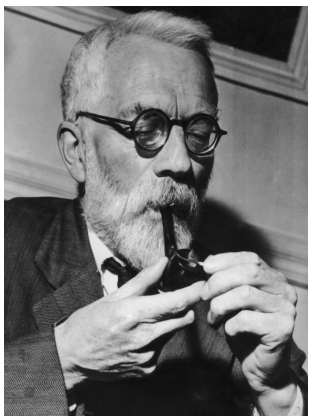
But Churchman and Rudner wouldn't have realized this

Fisher and Neyman don't start describing the debate in these terms until the mid-1950s.

To the extent that their disagreement was public before that point, it seems to have been viewed as largely fueled by personality.

In other words: I don't think it's fair to view Churchman and Rudner as intervening in the ongoing debate (even unwittingly) because the debate was not (yet) explicitly about whether scientists should be making decisions.

Indeed, Fisher seems to accept the main point



"It is open to the experimenter to be more or less exacting in respect of the smallness of the probability he would require before he would be willing to admit that his observations have demonstrated a positive [read: non-chancy] result."

- Fisher (1935, 15)

(This passage re-appears word-for-word in the last edition of *The Design of Experiments* and every other version that I have checked.)

A question

If the Fisher-NP debate is still on the horizon in 1947/1953, what would Churchman and Rudner have seen when they looked at the statistical literature?

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If the Fisher-NP debate is still on the horizon in 1947/1953, what would Churchman and Rudner have seen when they looked at the statistical literature?

Progress.

Recall Churchman

Churchman (1947): credits Wald with the central insight.

Wald doesn't just say that the scientist must consider costs, he introduces a weight function so that the consideration of costs can be a part of the mathematical problem.

What is progressing?

Not: the recognition of the influence of "costs" (i.e. "values") on science.

Instead: giving a procedure (operationalization?) for moving from values to scientific decisions.

Precisely what Fisher objects to

One of Fisher's central complaints against Wald (and by extension, Neyman) is "accepting wrongly" is not comparable to rejecting wrongly (the latter is all that plays a role in Fisherian significance tests):

> "The frequency of ['accepting wrongly'] must depend not only on the frequency with which rival hypotheses are in fact true, but also greatly on how closely they resemble the null hypothesis. Such errors are therefore incalculable both in frequency and in magnitude merely from the specification of the null hypothesis, and would never have come into consideration in the theory only of tests of significance, had the logic of such tests not been confused with that of acceptance procedure."
>
> - Fisher (1955, 70, 73)

And essential to Rudner's argument

It's the scientist *qua* scientist who must make value judgments. (Not the scientist "*qua* father, *qua* lover, *qua* member of society.")

It matters whether value judgments actually enter into the scientific procedure.

Rudner's innovation and the structure of the argument from inductive risk

The statistical approach to values

Neyman and Pearson:

> "Is it more serious to convict an innocent man or to acquit a guilty? ... The use of these statistical tools in any given case, in determining just how the balance should be struck, must be left to the investigator." (Neyman and Pearson 1933, 296)

Wald:

> "The statistician who wants to test certain hypotheses must first determine the relative importance of all possible errors end this will depend on the special purposes of his investigation." (Wald 1942, 40–41)

Rudner on values

"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.*"

- Rudner (1953, 2)

A transformation?

For Neyman and Pearson, Wald: statistical decisions (i.e., science) require non-scientific / pragmatic *evaluation* (does x satisfy present goals better than y?).

Rudner: statistical decisions (i.e., science) require non-scientific / pragmatic *evaluation*, **and** these evaluations must be guided by ethical principles.

Not "epistemic" vs. "non-epistemic" values

Rather, between the *act of making a judgment* and the *grounds for that judgment*.

Not "epistemic" vs. "non-epistemic" values

Rather, between the *act of making a judgment* and the *grounds for that judgment*.

Effectively, Rudner is making two importantly different claims:

1. A claim about science: namely, that it requires judgments.
2. A claim about *ethics*: it "obviously" requires that said judgments account for how serious a mistake would be.

Conclusion

Wrapping up

1. History: Rudner gets the argument from statistics – ultimately from Jerzy Neyman and Egon Pearson.
2. Context: Rudner probably viewed statistics as *progressing* towards a "scientific" treatment of values.
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