# 13. Naturalism

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# Should philosophy of science be useful to science?

## Sceptical physicists:



Richard Feynman (1918-1988)

Philosophy of science is as useful to scientists as ornithology is to birds."



1. Naturalism

of Scientific Labor

Theory-Ladenness of Observation
 Social Structure and the Division

"...we should not expect it [philosophy of science] to provide today's scientists with any useful guidance about how to go about their work or about what they are likely to find."



Steven Weinberg (1933-2021)



Neil de Grasse Tyson

"...we learn about the expanding universe...we learn about quantum physics, each of which falls so far out of what you can deduce from your armchair that the whole community of philosophers... was rendered obsolete."

Really?!?

"Philosophy is dead."



Stephen Hawking (1942-2018) *Foundationalism*: To describe science, one needs to stand *outside* of science.

- *<u>In other words</u>: Providing an account of science is different from doing science.* 
  - Foundationalist philosophy of science isn't concerned with being a useful guide for scientists, just like ornithology isn't concerned with being a useful guide for birds.
  - Historians and sociologists of science study science, as opposed to doing science. Why criticize philosophers of science for not doing something they aren't trying to do?

*Example*: Why are many prominent contemporary physicists so opposed to philosophy?

- <u>Answer</u>: Pedagogy! After World War II, there was an exponential increase in enrollment in physics PhD programs.

"The massive training mission that ensued—bolstered in the US by tens of thousands of new federal fellowships in physics and allied fields—radically changed how physics was taught..."\*

- Old pedagogy: Focused on conceptual foundations.
- New pedagogy: "Shut up and calculate!"

- Foundationalism based on logical analysis (logical positivism, logical empiricism) has been shown to be inadequate.
- And: Many physicists think philosophy is useful for practicing scientists.



Albert Einstein (1879-1955)

"A knowledge of the historic and philosophical background gives that kind of independence from prejudices of his generation from which most scientists are suffering. This independence created by philosophical insight is—in my opinion—the mark of distinction between a mere artisan or specialist and a real seeker after truth"

"Philosophy has always played an essential role in the development of science, physics in particular, and is likely to continue to do so."



Carlo Rovelli



Francesca Vidotto

"There is no physicist who does physics without being guided by some kind of philosophy... All the great physicists, of the past and of the present, had very good training in philosophy."

"Physicists should stop saying silly things about philosophy."\*



Sean Carroll

*Naturalism*: "Philosophy is continuous with science."

 <u>Claim</u>: Philosophy can use results from science to help answer *philosophical* questions about science itself.

### Metaphysics and Physics

- What is the nature of space and time?
- What is fundamentaly real?
- Is the universe predetermined?

### Metaphysics and Biology and Chemistry

- What is a species?
- How do complex systems supervene on simple systems?
- What is the source of life?

Epistemology and Psychology

- What are belief states?
- What is knowledge and how is it obtained?
- What constitutes an observation?

# 2. Theory-Ladenness of Observation

How neutral (objective) are observations?

Theory-Ladenness of Observation

<u>Weak Version</u>: The observations that affect theory choice are filtered through a process influenced by theoretical beliefs.

Holism about testing

*Strong Version*: The experiences that a person has are influenced by their beliefs, including their theories.

Recall inverted
 goggles experiements.

- How can we assess the Strong version?
  - Naturalism: Look to psychology...





- Both lines are the same length.
  - Lower one seems longer because of unconscious use of background assumptions in processing visual inputs.

Evidence for theory-ladenness of observations?

- Not for Strong Version:
  - The illusion is not affected by the knowledge that it is an illusion!
  - <u>Suggests</u>: Background assumptions are not "high-level" theories, but rather "low-level" assumptions (nature of 3-dim space, effect of distance on apparent size, etc).

<u>Naturalist's Moral:</u>

Observation is a natural phenomenon that psychology is equipped to better understand than, say, philosophy of mind.

# 

• Recall Hobbes' *Leviathan*: Life in the state of nature is...

"...solitary, poore, nasty, brutish, and short"!



#### <u>Why</u>?

- Humans are characterized by
  - (A) *Equality*: Both physical and mental.
  - (B) *Egoism*: Humans act with their own self-interest at heart.
- <u>And</u>: (A) and (B) inevitably lead to conflict.

### But why not cooperate?

- <u>Decision theory analysis</u> ("Prisoner's Dilemma")
  <u>Set-Up</u>:
  - J and S are suspected of a joint crime and police lack evidence to convict them.
  - Each prisoner is given following deal:
    - (a) If J confesses and S keeps quiet, then J gets 1 year and S gets 20; and *vice-versa*.
    - (b) If neither confess, then both get 3 years.
    - (c) If both confess, both get 10 years.



	S keeps quiet	S confesses
J keeps quiet	J gets 3; S gets 3	J gets 20; S gets 1
J confesses	J gets 1; S gets 20	J gets 10; S gets 10

- <u>*Dilemma*</u>: If both make the same choice (equality), then they are better off keeping quiet. But if they desire to minimize jail time (egoism), then each should confess.
- *<u>Claim</u>*: Confession is a "dominant strategy". Each gets a better result if he confesses:
  - If X's partner keeps quiet, then X will prefer to confess. If X's partner confesses, then X will prefer to confess.

<u>Moral</u>: It is not unreasonable to claim that equality and egoism lead to conflict rather than cooperation!

## 3. Social Structure and the Division of Scientific Labor

Another example of a naturalistic approach to philosophy of science...

• Science as a combination of cooperation and competition.



 <u>Specific question</u>: How can resources be distributed over several research programs all addressed to the same problem in order to maximize the chance that the problem will be solved?

- Hedge your bets? Distribute resources over all programs?

### Relevant questions

• Suppose (ideally) there is "Top-Down" control over science:

How can the degree to which one program is more promising than another be quantified?

How can a program with *decreasing marginal returns* (becomes less effective the more workers you assign to it) be identified?

- Suppose (realistically) that there is no "Top-Down" control over science:
  - <u>Assume</u>: Science works on a reward system (prestige).
  - <u>Assume</u>: Individual scientists are motivated by self-interest (obtaining rewards).

What kind of reward system in science will produce distributions of workers that benefit science as a whole?

What kind of reward system will produce the same distribution of workers that the Top-Down Control system produces?

<u>Option 1</u>: Give fixed reward to everyone who works on the program that eventually succeeds, regardless of how many workers there are.

<u>Option 2</u>: Reward individuals for making choices that produce the maximum benefit in terms of the overall chance that the community will solve the problem.

No bet-hedging:

- Incentivizes working on
  - most promising program.
- What if it fails?

<u>Unrealistic</u>:

- How could it be implemented?

<u>*Option* 3</u>: Reward *equally* only those who work on the program that eventually succeeds.

#### **Optimal! Hedges bets:**

- Incentivizes working on small programs: Reward is diluted in crowded programs.
- Incentivizes working on less-promising programs: Maximizes expected payoff.

Kitcher's account of the social structure of science

## <u>*But*</u>: Does Option 3 encourage "free riding"?\*



Joining a promising crowded program and contributing a minimal effort for a better chance of a smaller reward.

versus

 $E = mc^{1.97823}$ 

<u>*Option* 4</u>: Reward an individual in proportion to the contribution she makes to the program she joins, and if that program eventually succeeds. <u>Option 3</u>: Reward equally only those who work on the program that eventually succeeds.



Joining a smaller, less crowded program and contributing a larger effort with a lesser chance of a larger reward.

- Incentivizes working on smaller, lesspromising programs (like Option 3).
- Discourages free rides: Early joiners with greater contribution get more reward than late joiners with less contribution.

### **Open Questions**

- How might we get a community of individuals to behave in a "scientific" way?
  - Scientists need to make a living.
  - Society as a whole must allow questioning and open-ended inquiry.
  - There has to be a balance between competition and cooperation of an appropriate sort.
- Is there only one way to do this?
  - Intense, egoistic competition of Western market-based societies?
  - Less competition and more cooporation of communitarian or socialist societies?
  - Male-centric, female-centric, etc., societies?